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Contents

News of the Industry 161

Calendar of Coming Events 170

Just Among Ourselves 171

Laminated Sheets Give Sound Damping in Budd Steel Roofs. By Joseph Geschelin 172

New Recording Method for Electric Engine Indicator Gives Positive Card Directly. By George T. Hemmeter 177

Automotive Abstracts 179

Low-Run Step Plate Production Problem Solved by Die-Casting 181

Demand for More Power and Less Weight Stimulates Interest in Superchargers. By Joseph Jandasek, M. E., E. E. 182

Phenol Plastics Gain in Automotive Application. By Herbert Chase, M. E. 187

Production Lines 189

New Developments 190

Advertisers' Index 40

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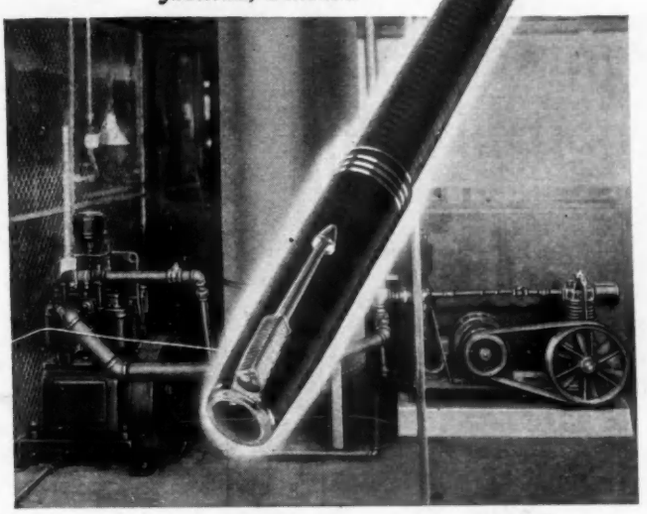

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AUTOMOTIVE INDUSTRIES

Vol. 72, No. 6 ▫ THIRTY-SEVENTH YEAR ▫ February 9, 1935

Jan. Output Exceeds 300,000

Fast Delivery Pace Taking Most of Current Production

by Athel F. Denham,
Detroit Editor, Automotive Industries

Automobile and truck production for the U. S. and Canada for the month of January exceeded the 300,000 mark forecast by *Automotive Industries* earlier in the month by some 10,000 units final summaries indicate. The total represents the largest January Production since 1926 with the single exception of 1929.

Virtually all manufacturers shared in the increased production total, including the independents, although in some cases important new models are not yet in full production. Furthermore, domestic retail deliveries are setting an equally fast pace, so that while some of the high production total is for the stocking of dealers with floor models, a high proportion has gone directly into the hands of the retail buyer.

Some slowing up in the sharp sales rise experienced at mid-month was more than offset by gains toward the month end in spite of the fact that weather conditions generally were not favorable to large-scale car buying. Another point to be noted is that all price classes shared in the sales increase, the highest price groups showing material improvement over last year.

(*Turn to page* 181, *please*)

McAneeny Resigns

The resignation of William J. McAneeny as president and general manager of the Hupp Motor Car Corp., was announced by Chairman A. M. Andrews following a meeting of the board of directors in Detroit on Thursday of this week. At the same time, Mr. Andrews revealed that Emlen S. Hare of New York, F. F. Beall, consulting engineer, Detroit, and L. A. Hebert, Chicago, had been elected to the board.

Mr. McAneeny was named Hupp president and general manager in the latter part of December, 1934.

New Models in Fall Urged in Henderson Report; Labor Conditions Criticized

Fall announcements and the revision of the automobile manufacturing code to provide for a 40-hr. maximum week with 48 hours permitted for not more than an 8-week period in any one year, are among the major recommendations made by the NRA Planning and Research Division in its report, which was finally made public this week, on its investigation of the possibilities of regularizing automotive employment and otherwise improving working conditions.

Coming as an anti-climax to the President's renewal of the automobile code, the report is severely critical of the industry, sustaining substantially all of the charges that have been made against it. The indictment is tempered somewhat by a reference to the "glorious achievements" of the industry and an admission that a study undertaken to uncover conditions to be improved must necessarily paint a dark picture.

In the letter transmitting the report to the President, the National Industrial Recovery Board emphasizes the exploratory character of the report, endorses the fall announcement plan, advises that the hours provisions in the code be amended, recommends that steps be taken to bring the automobile and other related codes into coherent relationship, and lastly urges that a comprehensive Automotive Industry Labor Relations Board be set up under the NIRA and Public Resolution 44 of the last Congress.

Reverting to the report itself, in connection with the fall announcement plan, it is recommended that provision be made for exemption of small companies on a showing that compliance with the program would seriously impair their competitive position. The report says that the contribution of such companies far exceeds their importance in rank of production and their position should be protected.

Regardless of regularization plans, the report advises elimination of the average provision and amendment of the code to provide for one maximum 40-hr. week with 48 hours permitted during an 8-week period in any one year, time-and-a-half being paid for hours in excess of 40. The exemption from

(*Turn to page* 181, *please*)

Chrysler and DeSoto Airflow Prices Cut

Price reductions of $180 on the DeSoto Airflow and up to $200 on the Chrysler Airflow models have been announced, effective midnight, Feb. 7. The Chrysler Airflow eight now lists at $1,245, a reduction of $100; the Airflow Custom Imperial at $1,475, instead of $1,675; the DeSoto Airflow models now list at $1,015. The overdrive remains standard on the Custom Imperial and has been reduced from $35 to $30 on the Chrysler Airflow eight and DeSoto Airflow six. Prices on the Airstream lines for both makes remain unchanged.

F.D.R. Squarely Behind ALB in Vigorous Reply to Ogburn's Nullification Letter

President Roosevelt put himself squarely behind the Automobile Labor Board this week in a vigorous answer to a letter from Charlton Ogburn, counsel for the A. F. of L., in which the latter sought to prove that the Federation's withdrawal from the automobile settlement nullified that arrangement.

In refuting Mr. Ogburn's contention that the settlement was an agreement and that the withdrawal of one of the parties to it terminated its existence, Mr. Roosevelt said that "the board was established by the government and not as a Board of Arbitration created by the parties to an agreement. . . . The board so established is responsible to the President and it is for the President to determine whether the board is fulfilling its duties and how long the existence of the board should be continued."

Inferentially the President's letter also was a frontal attack on the efforts of the Federation to saddle the President's advisors, particularly Donald Richberg, with the responsibility for the code renewal, to avoid putting organized labor in the position of attacking Mr. Roosevelt. Indirectly, too, the letter criticized the Federation for not availing itself of the opportunity afforded by the elections to establish the "authentic character of its representation."

Concluding, Mr. Roosevelt said that to annul or impair the powers of the Automobile Labor Board now would be an interference with the legal rights of workers freely to designate their collective bargaining representatives.

Mr. Roosevelt's letter follows:

"Your letter of Jan. 28 and communications along the same line, to which you refer, place a construction upon the creation, powers and functioning of the Automobile Labor Board, with which I cannot agree. The board was established by the Government and not as a Board of Arbitration, created by the parties to an agreement.

"There was in March, 1934, the possibility of a strike in this industry, arising out of controversies particularly concerning the right of employees to organize freely for collective bargaining. The 'principles of settlement' at that time recognized, not only the possibility, but the probability that groups of employees in this industry might choose different representatives or organizations to act in their behalf. Provision was made for the NRA to set up 'a board responsible to the President of the United States' and in the 'principles of settlement' it was stated that 'the Government makes it clear that it favors no particular union or particular form of employee organization or representation.

"The board established by the Government was, therefore, created for the benefit of all employers and employees in the industry and to prevent discrimination against any employee who exercised his right freely to designate his representatives for collective bargaining.

"The board so established is responsible to the President and it is for the President to determine whether the board is fulfilling its duties and how long the existence of the board should be continued. The board was not established in the code; but it will be noted that the Authority under which the board and the code were both established expires June 16, 1935.

"In the original creation of the board there was no provision for the nomination of the members of the board by any one and in accepting advice, or giving to persons an opportunity to suggest selections, the Government did not give to any one a right to name members or otherwise to determine the membership of the board.

"At the present time the board is not only functioning to prevent discrimination against employees and otherwise to carry out the purposes of its creation, but it is engaged also in the very important work of holding elections, whereby through secret ballot, under Government supervision, all employees are being given a full and fair opportunity to designate their representatives, choosing them either as individuals, or as representatives of a labor organization. The result of these elections must be to provide for the first time conclusive evidence of how and by whom the employees desire to be represented.

"When these elections are completed, the freely chosen representatives of the employees will be able to associate themselves together to bargain collectively, or otherwise to represent the interests of their constituents. Thereby both the employers and the Government will be able to determine the wishes of the employees and will be assured that those who claim to represent the employees and their wishes are in fact, their duly designated and authorized representatives.

"Under these circumstances, it would seem that any organization of employees in this industry, or any organization claiming to represent such employees, would avail itself fully of the opportunity to establish the authentic character of its representation.

"From the reports of recent balloting in the elections now being held, it appears clearly that all but a very small percentage of the employees are availing themselves of this opportunity. If the Government should, at this time, annul or impair the power of the Automobile Labor Board to conduct these elections, it would be placed in the position of preventing the employees from voting instead of fulfilling its promise to afford them a full and fair opportunity to exercise this right."

New Safety Inner Tube Introduced by Goodyear

A new safety tube for pneumatic tires has been announced by the Goodyear Tire & Rubber Co., Akron, Ohio. It consists really of two tubes, one inside the other and joined to it at the base, a single vent hole connecting the two air chambers.

The outside tube is similar in function and appearance to a regular tube and fits against the inside of the casing, while the inside tube or "lung," which is built of two plies of fabric, floats within the former. The tube is inflated in the usual way, the vent hole permitting air to pass from the inner to the outer chamber, so that in ordinary service the inner carcass is under no strain, but floats freely inside the tube, without chafing.

When a blowout occurs the air escapes from the outside chamber immediately, but from the inside chamber it can escape only through the single small vent hole. Thus only a portion of the air is lost in the blowout and the tire drops slightly to ride on the inner fabric carcass, which loses its air very slowly. This, the makers explain, permits the car to continue under perfect control, giving the driver ample time to pull off the road and stop without danger.

A demonstration of this safety tube was given recently at Floyd Bennett Field, N. Y., before safety officials and members of the press.

Include New Capital In Modified P-A Plan

Required Creditors Agree To Revise Scheme for Company Reorganization

Plans for the reorganization of the Pierce-Arrow Motor Car Co., designed to place the company's operations upon a profitable basis, are rapidly progressing toward completion, according to information laid before Federal Judge Rippey in the United States District Court this week.

Modifications of the plan filed Oct. 29 were presented by John Lord O'Brian in behalf of the company, which, it was stated, had been worked out in conference with the principal creditors. These modifications provide for the raising of ample additional working capital and will place the company in a strong financial position. Mr. O'Brian stated that creditors in excess of the required two-thirds in amount, in all classes, either have signed formal consents to the modified plan or have signified their willingness to sign.

The court directed that copies of the modifications of the plan be sent to all creditors and stockholders and that a hearing be

Amendments to Automobile Code Approved by President Roosevelt

In addition to extending the automobile manufacturing code to June 16, 1935, unless the emergency shall be declared ended sooner, President Roosevelt, as reported in last week's issue, approved three amendments to the code which follow in full:

Work by any employee in excess of forty-eight hours in any week shall be paid for at the rate of time and one-half for such overtime. Any provision of said Code inconsistent herewith is hereby modified to conform to this requirement. This requirement shall not be construed to authorize or permit work in excess of forty-eight hours when such work is prohibited under any of the provisions of the Code.

The members of the industry are requested and authorized to enter into agreements with one another with respect to Fall announcements of new models of passenger automobiles and the holding of automobile shows in the Fall of the year, as a means of facilitating regularization of employment in the industry.

The members of the industry will comply with the provisions and requirements for the settlement of labor controversies which were established by the government and have been in operation since March 1934, and which are hereby confirmed and continued.

held on the question of confirmation before the court on Feb. 18.

The company reports a favorable January business, the entire month's production having been oversold by 30 per cent. Advance orders for February delivery likewise have built up a substantial bank of business for the current month with indications that the oversold condition will continue.

Mayo Enters New Field As Zonolite Corp. Head

William B. Mayo, formerly chief engineer of the Ford Motor Company, and widely known for other engineering activities, has entered a new field as president of the Zonolite Corp. of America, manufacturers of insulating material. The product is used as insulation in open-hearth furnaces, in acoustical correction and in home insulating.

R. T. Walker, who was assistant to Mr. Mayo during his Ford Motor Company connection, will act in a similar capacity with Zonolite Corp.

Donald Richberg, standing, Emergency Council director, and S. Clay Williams, seated center, chairman of NIRB, announce President Roosevelt's acceptance of the amendments to the automobile code and his extension of the code until June 16, the expiration date of the Recovery Act, at a press conference in Washington

Wide Difference in U. S. Shipment, Output Totals

A rather large discrepancy exists between the December total of factory shipments of new motor vehicles, commonly referred to as production, as reported by the Census Bureau, and the number of units actually built in that month, according to a careful survey made by *Automotive Industries*.

The Census report shows some 185,000 vehicles for December, whereas the number actually built was about 138,000 to 139,000, which was the estimate given in the Jan. 5 issue of this publication. This estimate checks rather closely with an AMA release which put December shipments of member companies at 116,000, leaving 22,000 for Ford, which was approximately about what the Dearborn manufacturer turned out.

A. F. of L. Goes into a Tantrum over Renewal of Automobile Code

by L. W. Moffett

Washington, Feb. 5.—The rage of the American Federation of Labor over the renewal of the automobile manufacturing code is analyzed here as an alloy of genuine exasperation and a certain amount of window dressing.

Organized labor is irate that the White House disregarded its demands. It is enraged that it made such a dismal showing in elections in the automotive industry which left it with but little ammunition, aside from hot words, more or less sophomoric phrases and the usual threats of strikes. Behind these fulminations, there is considerable opinion here that there is a good deal of pretense since it is believed that some union leaders at least recognize that, "to keep the boys in line," the Federation is advocating moves which are impossible economically at this time.

Probably nothing in connection with the extension of the automobile code irked the Federation more than the blessing the President gave to the Automobile Labor Board. Having withdrawn from participation in the Board's activities, the Federation was demanding that it be abolished and denounced its head, Dr. Leo Wolman, whom it expected to be subservient to its demands.

The Federation was further irritated when the President at his press conference last Friday spoke of the ALB as his "baby." And it is his "baby" because more than any one else, he is held to have been responsible for its creation and the principle of proportional representation underlying it. This principle is widely accepted by industry and by unaffiliated labor, and originally was endorsed by the A. F. of L. Nevertheless the Federation affected to think, before the code was renewed, that the President would abolish the Board.

The President's inclusion of the provision requiring time and a half for hours worked in excess of 48 per week, according to Mr. Richberg, was opposed by the manufacturers. Evidently he cited this opposition to answer the claim that the industry forced this provision on the administration. This amendment also drew the fire of the Federation which had hoped for time and a half for all hours in excess of 40.

Further criticism of the code renewal came from the Federation on the grounds that the action was taken despite the fact that the majority of the National Industrial Recovery Board voted against the extension. The fact that the President over-rode the NIRB majority is regarded as evidence that on major NRA issues, he proposes to make the decisions.

At the final conference on the code last Thursday afternoon, Alfred P. Sloan, Jr., and Walter P. Chrysler met with the President. Others who represented the industry in the negotiations included Donaldson Brown, John Thomas Smith and W. S. Knudsen of General Motors, Roy D. Chapin of Hudson, and Alfred Reeves and Pyke Johnson of the Automobile Manufacturers' Association.

Following the renewal of the code, William Green, Federation president, said that organized labor "rejects, won't accept and will not yield" to the renewed and "imposed" automobile code. He has asked for an investigation by Congress of the automobile industry. He has said renewal of the code means that the New Deal has "surrendered to big business." He has raked Mr. Richberg fore and aft for not consulting organized labor in negotiating for renewal of the code. Mr. Lewis, leading the attack, has called Mr. Richberg, former railroad brotherhood attorney, a traitor to labor, which "nurtured" him. Mr. Richberg has shot back that loyalty to the United States dictated his action.

In answer to charges of organized labor that it was not consulted in connection with renewal of the automobile code, Mr. Richberg replied that during the investigation the views of all those claiming to represent labor interests were thoroughly canvassed in conferences in 13 cities.

A. O. Smith Employment Up

A. O. Smith Corp., Milwaukee, during the last 90 days has increased its payroll from 3700 workers to approximately 5250, due to heavy shipping specifications on automobile frames as well as sharply increased activity in its pressure vessel division.

Industry Focuses on Details of Fall Announcement Plan for Regularizing

by Don Blanchard
Editor, Automotive Industries

The amendment to the automobile manufacturing code requesting and authorizing members to enter into agreements for fall announcements of new models and the holding of automobile shows during that season in order to give steadier work and larger annual incomes to automotive employees, follows many months of consideration of the regularization problem, both by the government and the manufacturers.

In announcing the renewal of the code, the President said that the manufacturers had expressed their willingness to go along with the plan. Subsequently it was revealed in a statement issued by the Automobile Manufacturers Association that some of the details of the proposal had already been considered, member companies having adopted a resolution last December reading in part: ". . . the undersigned members of the Automobile Manufacturing Industry, beginning with the year 1935, hereby agree to confine the annual announcement of new models of passenger cars as nearly as possible to the month of October . . . it will be considered a violation of this Agreement for any manufacturer to announce new models 60 days before or after October 1 . . . the first Automobile Show exhibiting new models shall be held not later than November 5."

Agreements worked out under the authority of the code amendment presumably will follow the pattern of this resolution although they may differ in some details. However, it is clear that the purpose of the proposal is to advance the beginning of the new model production season by two months or thereabouts, and thus lift both production and employment to higher levels during the winter months and put the unavoidable lay-offs prior to new models into the summer when they will impose less hardship. Of course, there are some manufacturers who had already planned to make announcements prior to 60 days before Oct. 1 and it is considered probable that they will carry out their plans. Such announcements, it is felt, will not reduce the effectiveness of the plan materially as it is held that the most important phase of the proposal is to get all announcements made prior to the beginning of winter. This is primarily why the latest date at which the first show can be held is specified in the resolution since it is felt that all the manufacturers will want to have their new jobs ready for display at that exhibition.

One of the problems of the industry in seeking to level out production and employment, the AMA statement referred to previously says in discussing the plan, is to make what changes are possible in buying demands. Continuing, it says, "The industry believes that the most effective way to deal with this problem is to endeavor to stimulate buying in the fall. It also believes that the most promising way to stimulate fall buying is to introduce new models at that time."

To equalize employment during the winter months, the plan provides in addition for the production during that season of motors, front and rear axles, transmissions, steering gears, forgings, castings, and so forth, in excess of immediate requirements as a bank stock to be used up during the spring peak. The object obviously is to shift some of the spring peak in employment into the winter valley. This feature of the plan, of course, dovetails with the fall announcement program.

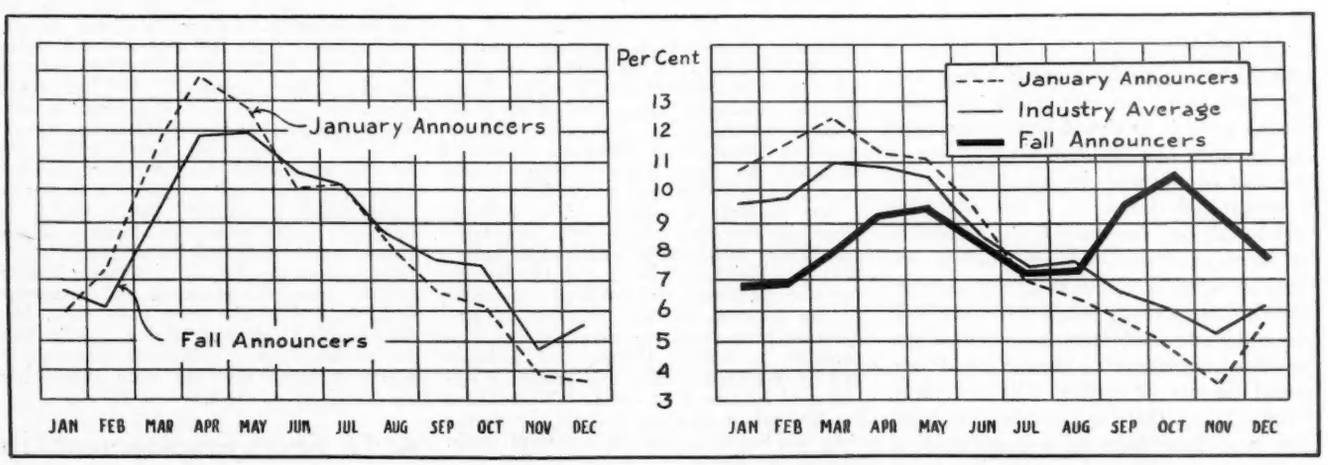
Summarizing, the following advantages are listed for the fall announcement plan:

(1) It will stimulate the buying of automobiles in the fall and winter by encouraging the purchase of new models at a time when demand is usually low and thus tend to reduce the spring peak.
(2) It will stock dealers at a quiet time and thus avoid the present necessity of stocking dealers at a time when the industry is also crowded to meet the spring peak.
(3) It will enable the manufacturers to make more accurate forecasts of consumer demand and thus enable them to produce unit parts in advance of finished car assembly.

Jan. Output Topped Only By '29, '26 Production

More cars and trucks were built in January than in any January in the history of the industry with the exception of 1929 and 1926, the preliminary estimate of production in that month issued this week by the Automobile Manufacturers Association shows. January output is estimated at 306,000, a gain of 87 per cent over the same month last year and of 65 per cent over December.

Fall Announcers Show Smaller Monthly Variations in Sales and Man-Hours



Retail sales—Sales of the fall announcers do not reach so high a peak nor fall into as deep a valley as the January announcers. The curves are based on AMA member company figures averaged for 1928 through 1932. The ordinates show average monthly sales as a percentage of the average yearly total during the period

Man-Hours—Fall announcers provide more stable employment over the year than do January announcers or the industry as a whole. The curves are based on AMA member company figures averaged for 1929 through 1932. The ordinates show average monthly man-hours as a percentage of the average yearly man-hour total during the period.

C. W. Nash, second from right, celebrated his seventy-first birthday by playing 18 holes of golf at the Wilshire Country Club in Los Angeles. With him are J. T. Wilson, left, a Nash director; "Whiffy" Cox, professional golfer; Mr. Nash; and Willie Hunter, the noted tournament player. Members of the Los Angeles Chamber of Commerce presented the birthday cake

(4) It will throw any unavoidable slack periods into the summer months when the effect on the employees will be less burdensome than in the winter months as at present, and

(5) It will facilitate the training of men to work on the new designs when the industry is not pressed to stock dealers for the spring peak and thus make for more efficient and more continuous production.

To illustrate the difficulties of forecasting production and sales, due to seasonal fluctuations and year to year variations, the statement shows that in the last seven years monthly retail sales, as a percentage of the year's business, have varied between the following limits:

	%		%
January	3.26	to	7.98
February	4.65	to	8.06
March	5.27	to	11.38
April	8.03	to	13.93
May	10.73	to	13.14
June	9.93	to	13.57
July	9.50	to	12.43
August	7.76	to	11.96
September	6.55	to	10.58
October	5.38	to	9.13
November	3.54	to	6.77
December	3.58	to	4.94

In the recent past, with most model announcements around January 1, the period from the announcement date to the peak retail months, the statement explains, has been too short to permit production of either cars or parts in sufficient quantities to lower the spring peak appreciably. Fall announcements are expected to meet this problem and at the same time to allow sufficient time after the spring peak to permit liquidation before the following year's models are introduced. October is regarded as the most desirable fall month for announcements because a later date would not provide the biggest stimulus to sales and, moreover, final commitments for materials on current models could be made as late as June which would give time for liquidation. Moreover, it is felt that October is not late enough to restrict spring buying. The experience of manufacturers who have applied some of these principles to their operations is said to bear out this reasoning.

Cole Resignation

Rufus S. Cole, executive vice-president and a director of Hupp Motor Car Corp., has completed negotiations which have resulted in his severing all business connections with that corporation as well as resigning as executive vice-president and a director. Mr. Cole made no statement regarding his future plans.

MEMA Show Simultaneous With Car Display Proposed

Members of the MEMA have been asked to consider the possibilities of an aftermarket show controlled by that association and to be held in New York the same week as the automobile show. The proposal suggests that the equipment exhibition might be held at Grand Central Palace or the Port Authority Commerce Building, if the automobile show is held in either of these buildings, or in the latter building regardless of where the automobile show is held.

2 New Models By White

New improved truck models augmenting the 700 series are announced by the White Motor Co. The added models are designated as 701 and 702, and the series now meets every gross weight requirement from 8000 to 60,000 lbs.

Toledo Pay Increases Stall Labor Troubles

Spicer, Auto-Lite, L-O-F Agree to Wage, Contract Adjustments for Workers

TOLEDO, Feb. 6—Labor troubles were avoided in two Toledo parts plants today when contracts were signed by the workers of the Spicer Manufacturing Corp., involving a wage increase of more than 10 per cent, and when workers of the Electric Auto-Lite Co. approved a settlement worked out by their committee and management. The Auto-Lite agreement is an amendment of the contract now in effect in that plant and recently extended. It carries wage adjustments not yet announced, but believed to be more than 5 per cent.

The contract is scheduled to be signed tomorrow.

The Spicer contracts with the United Automobile Workers Federal Union No. 18,384 and Mechanics Educational Society provide for 5 cents an hour flat increase to all workers and an additional 5 per cent for all receiving less than 54 cents now. Other readjustments will also be made in some groups and departments. Increases range up to 18 cents an hour, union officials said.

Charles A. Dana, president of Spicer, said the advances were readily agreed to due to the increase in cost of living. He said the only problem is to prevent costs

(*Turn to page* 181, *please*)

U.S. 1934 New Car Registrations Gain 32%; Chevrolet Beats Ford for High

Registrations of new cars and trucks in the United States totaled 2,292,443 in 1934, an increase of 32 per cent over the 1933 total of 1,739,663.

As the result of a spurt in the second half, Chevrolet took first place in both car and truck registrations, with Ford a close second and Plymouth third. Chevrolet car registrations amounted to 534,906 against 530,528 for Ford, while in trucks Chevrolet got 157,507 as compared with the Ford total of 128,250. In combined cars and trucks, Chevrolet had 692,413 against 658,778 for Ford.

The division of the total domestic market for cars and trucks in 1934 and 1933 among the three largest producers and the remaining manufacturers is shown by the following table:

	Per Cent of Total Car and Truck Registrations	
	1934	1933
General Motors	40.1%	43.2%
Chrysler	21.0	23.9
Ford	28.8	21.6
All others	10.1	11.3

It will be noted that of the four groups only Ford increased his percentage of total, the others showing decreases. This follows from the fact that Ford was the only group to show an increase over 1933 larger than the industry average, as the following table shows:

	U.S. New Car and Truck Registrations (000 omitted)		Per Cent Increase
	1934	1933	
General Motors	920	753	+22
Chrysler	480	415	+16
Ford & Lincoln	661	375	+76
All others	231	196	+18
Total	2,292	1,740	+32

Complete 1934 registrations of new cars and trucks are presented in tabular form on page 176 of this issue, from which the details on individual makes can be obtained.

Barber Succeeds Delaney

George Barber has been named assistant deputy administrator in charge of the Motor Vehicle Retailing Code, succeeding Joseph F. Delaney, who has been advanced to administration member of the dealer code authority.

Business in Brief

Written by the Guaranty Trust Co., New York, exclusively for Automotive Industries

The upward trend in general business and industrial activity continued last week. The demand for winter goods caused by the very low temperatures in many parts of the country substantially reduced the supplies of these commodities. One estimate of retail sales placed the increases from 12 to 20 per cent above the levels a year ago. Wholesale business also improved last week, mostly as a result of larger commitments for spring goods.

New R.R. Equipment

Class I railroads in the United States have placed 24,103 new freight cars in service thus far during this year, as against only 1879 new cars in the corresponding period last year. Fifty-nine new steam and 31 electric locomotives were installed, as against one steam and 37 electric locomotives in the corresponding period last year.

Fewer Car Loadings

Railway freight loadings during the week ended Jan. 26 totaled 555,768 cars, which marks a decrease of 7187 cars below those in the preceding week, a decrease of 7332 cars below those a year ago, and an increase of 80,476 cars above those two years ago.

Increase Current Production

Production of electricity by the electric light and power industry in the United States during the week ended Jan. 26 was 10.6 per cent above that in the corresponding period last year. Production during the preceding week showed a gain of 9.4 per cent above that a year earlier.

Farm Prices Rise

According to the Bureau of Agricultural Economics, the index of farm prices on Jan. 15 stood at 107, as against 101 a month earlier and 77 a year earlier. The current figure is the highest reached since November, 1930. The Bureau announced that during last year the level of prices received by farmers increased considerably more than the prices of commodities that farmers purchase.

Fisher's Index

Professor Fisher's index of wholesale commodity prices for the week ended Feb. 2 stood at 81.6, the same as the week before, as against 81.1 two weeks before. The figure for the current week and the preceding week is the highest reported since November, 1930.

Federal Reserve Statement

The consolidated statement of the Federal Reserve banks for the week ended Jan. 30 showed a decrease of $2,000,000 in holdings of discounted bills. Holdings of bills bought in the open market and of government securities remained unchanged.

Purchasing Agents Adopt Steel Bar Color Code

A color code for marking steel in bars (flat, oval, hexagon, round, and square) has been adopted by the National Association of Purchasing Agents. It was developed by its committee on Iron and Steel on the basis of the Society of Automotive Engineers' designation by number of the well-known kinds of steel.

The code gives color markings for SAE carbon, screw stock, nickel, nickel-chromium, molybdenum, chromium, chromium - vanadium, silico - manganese and tungsten steels, and for stay-bolt steel. According to a statement made by the National Association of Purchasing Agents' office, the color code has been made part of the Federal Standard Stock Catalog and is mandatory in all departments of the government.

The chance of successfully developing an American Standard Code now appears to be better. The American Standards Association would be interested in any suggestions.

Annual Manufacturers Census is Proposed

The report of the sub-committee on Elimination of Waste in Distribution of the Business Advisory and Planning Council of the Department of Commerce, made to Secretary Roper makes four specific recommendations. They are:

(1) A five year census of distribution. The National Retail Council had suggested such a census every two years, but the committee put it on a quinquiennial basis because of the cost involved; (2) that a sample census, not to exceed 10 per cent of the distribution establishments, be made annually; (3) that a population census be made every five years rather than every 10 years as has been the custom since 1790; (4) that an annual and quinquiennial census of manufactures be made inasmuch as it is felt adequate data as to the quantities and kinds of merchandise produced is essential for proper planning of distribution.

To Test Tailless Planes For Private-Owner Use

Plans for purchasing a tailless airplane and testing it to determine suitability of the design for a private-owner aircraft have been announced by Eugene L. Vidal, Director of Air Commerce, Department of Commerce.

One of a number of different designs with which the Bureau will carry on experimental and service tests, the tailless airplane was brought forward by Waldo D. Waterman of Los Angeles, Cal. The Bureau has contracted with Mr. Waterman to construct one airplane in accordance with plans and specifications which he submitted several months ago.

Stimulated Foreign Trade Anticipated by Export Men

The extension of reciprocal trade agreements by this government upon the most-favored-nation basis, as interpreted by Secretary of State Hull, was endorsed by the export managers of AMA member companies at a two-day meeting last week in Detroit.

Robert Graham, Graham-Paige vice-president and AMA export committee chairman, stated following the meeting that a marked stimulation of foreign trade for the United States is anticipated as a result of the consummation of several important reciprocal agreements now in course of negotiation. The export managers expressed their approval of this phase of the present administration's policy in a resolution addressed to Mr. Hull.

J. S. Marvin, AMA general traffic manager, reported that ocean shipping contracts closed during 1934 increased to 55,000,000 cubic feet from 23,500,000 cubic feet in 1933. Export men attending the meeting were: W. Ledyard Mitchell, E. C. Morse, Eugene Prince, Chrysler Export Corp.; R. S. Wiley, Auburn; C. E. Cordes, General Motors Corp.; R. G. Hudson, Studebaker; V. H. Wilcox, Hupp; C. M. Stempson, Graham-Paige; H. D. Dodge, Graham-Paige; H. M. Salisbury, Nash; A. L. Frank, Studebaker; Elijah G. Poxson, Reo; Robert C. Graham, Graham-Paige; S. Fitzpatrick, Federal; C. M. Wynne, Diamond T, and Norman Damon, George Bauer, J. S. Marvin and K. A. Moore, AMA.

Talk of Steel Strike Puts Future in Doubt

Automotive Demand Well Maintained; New Models Consume Larger Sheets

Although the pace of automotive demand is well maintained, showing in fact gains in some directions, the steel market outlook is becoming one of rising uncertainty. Threats of a "potential April 1 strike" emanating from a minority of insurgents in the unionists' ranks failed to perturb the steel industry very much, but did add to the sea of doubt that surrounds the market's future.

The American Iron and Steel Institute reports for the current week another gain in operations, 52.8 per cent of ingot capacity being employed, as compared with 52.5 per cent in the preceding week. Detroit district mills are operating at full capacity. Expressed in terms of the percentage of total sheet rolling capacity in operation, estimated at between 60 and 65 per cent, a distorted picture of the actual situation results.

Demand for certain kinds of sheets from motor car manufacturers and body makers is so heavy that every bit of equipment capable of producing these classes of sheets is being worked to the limit. Despite this capacity operation some consumers cannot be accommodated as promptly as they would like, while demand for other descriptions, in former years ranking among the best sellers, is relatively light. On the whole, however, new models, it is sensed, have ushered in an era of larger sheet steel consumption. Strip steel orders from parts makers continue to run heavy. Cold-finished steel bars and automotive alloy steels, especially chromium-nickel alloys, are enjoying satisfactory demand. A 1 cent per pound reduction has been filed for certain "stainless" steels.

Activity in wire rods reflects the continuing good demand for automotive bolts and nuts. Less is heard of possible upward revision of prices for certain flat steels when second quarter prices are filed next week. Opinion regarding the wisdom of such a move is so diverse the impression prevails that the price structure will be left unchanged.

Pig Iron—Automotive foundries continue to be the predominant class of buyers in the pig iron market. Most of these are satisfied, however, to cover their requirements month by month, and while this business is heavy in the aggregate, no single transactions involving spectacular tonnages, come to light. Prices are unchanged.

Aluminum—A marked increase in the use of aluminum in motor trucks and buses is reported by the sole domestic producer. Producers of secondary aluminum report the heaviest shipments in months, with prices realized quite satisfactory. Moreover, the supply of scrap is better and prices a shade easier.

Copper—Consumers' stocks have run low and some demand for immediate shipment is noted. No further developments with reference to an international pact among producers have come to light. Prices remain unaltered.

Dec. Employment, Payroll Indexes

	Adjusted for Seasonal Variation		
	Dec.	Nov.	Dec.
Factory Employment	96.6	77.4	71.8
Factory Payrolls	...	...	...
Production Index	105	37	45

	Without Seasonal Adjustment		
	Dec.	Nov.	Dec.
Factory Employment	88.9	67.1	66.1
Factory Payrolls	76.4	51.3	46.0
Production Index	58	24	25

Tin—While the supply of spot tin continues tight, buyers are marking time pending announcement of the Supreme Court decision on the gold clause. Straits tin was quoted at 51.05 cents at the opening of the week.

Lead — Storage battery manufacturers availed themselves of the opportunity to cover their nearby requirements on the 3.50 cent, New York basis. The market stiffened on Monday, one of the large interests announcing a $2 per ton advance.

Zinc—Quiet and unchanged.

Charles S. Crawford

Charles S. Crawford, former chief engineer of the GM Opel plant in Germany, died January 28 following an operation. At one time he was chief engineer of Stutz, Cole and Premier. He left Stutz to join the GM Export Corp., which eventually led to his Opel appointment. Mr. Crawford was a brother of J. M. Crawford, Chevrolet chief engineer.

Percy C. Avery

Percy C. Avery of Milwaukee, credited with originating the idea and first manufacturing pressure tank gas lighting systems for automobiles, died recently. He was 65 years old. The business formed the nucleus of the Prest-O-Lite Co., Indianapolis. In recent years Mr. Avery operated in Milwaukee as the Absolute Carbonic Service, 133 West Bruce Street.

French to Subsidize Racing Car Entries

Lebrun, Other Officials Sponsor Move to Revive Interest in World Meets

Under the patronage of President Lebrun and the Chairmanship of the president of the Automobile Club of France, a committee has been formed in France for the organization of a public subscription with the object of placing French racing cars back in international competitions. It is felt that the decline in the export business in French cars is in large part due to the eclipse of the French industry in international competitions, which this movement, it is hoped, will remedy.

Various subcommittees have been appointed, including a propaganda committee whose duty it will be to impress every French motorist and every Frenchman whose livelihood is dependent upon the prosperity of the automobile industry, with the importance of French competition in international automobile races.

It is realized that the time available is too short to make much of a showing during the coming season, but the committee feels that the full effect of its activities will become apparent in 1936. Nevertheless, it offers awards to those who may be ready to represent the French colors in the events of the coming season.

February has been designated "automobile month" and radiator insignia issued by the committee will be sold to motorists along the highways. Every car owner is to be told that it is the research work carried out in connection with the development of racing cars which makes possible worthwhile improvement in stock cars, this applying particularly to such important parts as tires and brakes. It is estimated that there are approximately 780,000 persons in France whose livelihood is dependent upon the automobile industry, from the miner of the raw materials that go into the cars, to the filling station attendant.

Passenger Car Production by Wholesale Price Classes

(U. S. and Canada)
12 Months 1934 and 1933 Compared

	1934	1933	Per cent of Total 1934	Per cent of Total 1933	Per cent change
Under $500	1,485,157	1,316,447	65.06	80.89	+13.0
$501-$750	686,260	237,099	30.07	14.57	+190.0
$751-$1000	66,223	32,610	2.90	2.00	+103.0
$1001-$1500	27,576	20,125	1.21	1.24	+37.0
$1501-$2000	8,391	10,409	.37	.64	—19.5
$2001-$3000	6,879	8,725	.30	.54	—21.2
$3001 and over	2,151	1,952	.09	.12	+10.1
Total	2,282,637	1,627,367	100.00	100.00	+40.5

Truck Production by Capacities

(U. S. and Canada)

	1934	1933	Per cent of Total 1934	Per cent of Total 1933	Per cent change
1½ tons and less	568,200	330,746	92.69	92.23	+71.9
2-3 tons	35,938	22,952	5.86	6.40	+56.4
3½ tons and over	6,463	3,610	1.06	1.01	+79.0
Special and buses	2,391	1,306	.39	.36	+83.2
Total	612,992	358,614	100.00	100.00	+71.0

U.S.-Brazil Trade Pact Should Aid Exports

Duties on Automotive Products Reduced 20%; No Quantity Restriction

The automotive industry is gratified over the reciprocal trade agreement negotiated between the United States and Brazil, as the result of which, according to a State Department announcement, automobiles, trucks and parts will benefit by a reduction of 20 per cent of the present Brazilian duty, while for tires and tubes the reduction is 25 per cent.

While the agreement is yet to be ratified by the Brazilian Congress, this is considered only a formality, ready to be completed as soon as the treaty, now being rushed to Brazil, reaches that country. It will become effective 30 days after instruments of ratification by the President of Brazil and of approval by President Roosevelt have been exchanged.

Expressing the views of the automotive industry, Robert C. Graham, AMA export committee chairman, and vice-president, Graham-Paige Motors Corp., sent a telegram of congratulation to President Roosevelt.

The Brazilian agreement was a source of satisfaction to the automotive industry not only by reason of the expected increase in exports to Brazil but also because this agreement and the preceding one with Cuba are the forerunners of others made under authority of the trade agreements act. The industry confidently believes these reciprocal trade agreements will mean substantially increased foreign markets for its products.

Automotive products constituted one of the outstanding lines of exports to Brazil before the depression, and in 1934 Brazil ranked tenth as the foreign market for American passenger cars and eighth for American trucks. It was second in the Latin-American market, being outranked only by Argentina.

The reduction of 20 per cent in duties on American passenger cars is estimated to be a decrease of from $50 to $400 per car for Brazilian purchasers of American automobiles. The assumption is that the lowered duty will be passed on to the purchaser. However, if the Brazilian schedules, by which duties as based on weight classification, are left unchanged, there will be an offset in the amount of the actual duties because of the increased weight of American cars whose tendency has been to be heavier than the older models. Otherwise the reductions would be greater than those indicated. Rates are stepped up with the classification until on the highest priced American cars they range up to $1,900.

But on typical cars duties now amount to $270, as in the case of the Ford Fordor; $280 in the case of the comparable Plymouth model, and $320 in the case of the smallest Chevrolet, the duties on the former two models being 47 per cent and on the last named it is 50 per cent. The duties named are those now prevailing and include a 10 per cent tax.

AFL Speaks for Self Only Say Other Labor Leaders

Statements attributed to William Green, AFL president, to the effect that "all automotive labor organizations expect the A. F. of L. to speak for them," were emphatically contradicted in Detroit, by heads of other labor organizations, although a majority of union leaders agree with the Federation's views on objections to renewal of the automotive code in its present form.

Arthur E. Greer, founder of the Associated Automobile Workers of America, pointed out that Mr. Green represents through the A. F. of L. at most only 5 per cent of automotive workers, and certainly did not represent either the AAWA or its worker members in any way. "Forrest G. Brown, president of AAWA, is our representative and the only one authorized to represent this organization," Mr. Greer stated. "Mr. Green is talking through his hat."

Matthew Smith, general organizer of MESA, holds the same views as Mr. Greer and denies that Mr. Green has any authority to talk for the MESA. "Moreover," Mr. Smith said, "we are not much interested in the automotive code one way or another, the way things stand. I don't believe any code means anything as far as giving the workers any rights are concerned. We didn't make any attempts to argue against the code in Washington for that reason. We feel that labor can obtain its needs only by the power of organization."

William E. Dennison of the Society of Designing Engineers with some 1200 local (Detroit) and 500 out-of-town members stated: "While in matters pertaining to the automotive code, such as the renewal thereof, without incorporation of requested changes, including the 30 hour week, we are in substantial agreement with Mr. Green, no one has any authority to speak for this organization except its officers."

Plant Elections Illegal Ogburn of AFL Declares

Carlton Ogburn, A. F. of L. counsel, has charged that the election rules and ballots employed by the Automobile Labor Board in collective bargaining elections are contrary to requirements of Section 7a and provisions of the Joint Resolution passed by Congress last year just before the spring recess.

Mr. Ogburn's contention is that the ballots provide no place where workers might record a vote for an organization of their choice and that the elections are held in plants where employees are "subject to the scrutiny of the officials of the company."

Defiance Spark Plug Corp.

The Defiance Spark Plug Corp. reports a net loss of $61,179 for the year ended Nov. 30, 1934, after expenses and other charges, comparing with $79,427 for 1933.

AAWA Gets 36 Places In Hudson Election

Wolman's Summary Reveals 90% of Eligible Workers Have Voted for Bargainers

For the first time since the Automobile Labor Board has been conducting collective bargaining representative elections in Detroit automobile plants, the majority of the nominees named by Hudson employees are identified with workers' organizations. The election was held last Saturday with 7560 employees participating.

An analyzation of the ballots showed that the Associated Automobile Workers of America nominated 36 candidates and the Hudson Industrial Association captured 57 places. The A.A.W.A. got 2858 votes, but these ballots were concentrated in such a manner that in number of nominees the Industrial Association placed 21 more names on the final ballot with 2732 votes. The unaffiliated vote was 1781, sufficient to nominate four candidates. Five other nominees got their strength from a variety of groups and will be permitted to select their affiliation in the final election. There are two women among the nominees, and women workers are assured of representation on the bargaining board when final elections are held next Friday.

In this voting the American Federation of Labor suffered another setback, going into third place while the newly organized A.A.W.A. moved into second place. Arthur E. Greer, A.A.W.A. chairman, was one of the nominees.

Dr. Leo Wolman's official statement summarizing the results of elections in 12 Detroit automobile plants, participated in by approximately 54,000 voters of an eligible 60,000, shows that while the Federation and the MESA instructed their membership to refrain from voting, that approximately 90 per cent of the eligibles voted.

The following summary covers elections in the Cadillac, Chevrolet forge, Dodge forge, Lynch Road truck, Amplex Division of Chrysler, Plymouth, Highland Park Chrysler, Main Dodge, Chevrolet gear and axle, Hudson Gratiot, Hudson axle and Hudson main plants:

Unaffiliated	40,953
Employees' Association	5,440
Associated Automobile Workers of America	3,124
American Federation of Labor	2,286
Mechanics Educational Society of America	314
Auto Workers Union	22
Auto Service Mechanics Association	16
Society of Designing Engineers	9
International Workers of the World	6
International Association of Machinists	1
Blank Ballots	624
Void Ballots	976
Total Ballots Cast	53,771

During the next two weeks the Board has scheduled primary elections in the Chrysler Jefferson Avenue, Chrysler Kercheval Avenue and Packard plants, and final elections in the Hudson, Chevrolet gear and axle, and Main Dodge plants.

Results of the workers' primary election Tuesday at the Jefferson and Kercheval Avenue plants of the Chrysler

Corp. duplicated previous results in other plants in that 6511 out of 7067 employees voting cast their ballots as unaffiliated, while only 200 voted affiliation with the A. F. of L.; 68 with the Chrysler Employees Association, 39 for the AAWA, and six for the MESA.

Results of the Dodge final election will not be available until after this issue goes to press. At this election 53 representatives will be selected. Questioned as to how this large number of employee representatives would function, a representative of the ALB explained that the bargaining council can operate by properly proportioned committees if it so desires, the large number being desirable from the standpoint of obtaining representation for every division of the large Dodge plant with its 20,000 employees. It is expected that the ALB will issue rules in the near future for the procedure to be followed by the various bargaining councils.

Fisher Management, Labor Fail to Agree

At Thursday's meeting of the Lansing Fisher Body workers, the A. F. of L. committee headed by C. B. Trotter which negotiated with the Fisher management presented its report that it failed to arrive at an agreement. Vote on a strike was postponed until Sunday afternoon, when a mass meeting will be held. The same report was presented to the day shift workers at a meeting Thursday night.

Efforts of the A. F. of L. to assume control of the situation at the Fisher plant in Lansing met with only partial success during the week. As reported last week, the controversy originated over the status of 46 wet sanders who walked out last week, causing a 24-hr. shutdown of the Olds and Fisher plants. The Federation desires, it is believed, to avert strike action until later in the month, when it is considering calling a "general" strike in the industry.

The men in question, who were not A. F. of L. members, have since been taken into that organization, which thereupon assumed leadership in dealing with the management. At a meeting Wednesday, demands that the men be reinstated along with "an improvement in working conditions" were turned down by the management. Edward Fisher, general manager of Fisher Body Corp., headed the group representing the management, which issued a statement to the effect that the new men who replaced the sanders were satisfactory and that production was running smoothly, indicating that no additional sanders were needed, but that men could apply for employment as new men. It is understood that the attitude of the management is that the men have lost their seniority by quitting their jobs.

A. F. of L. efforts to draw out the controversy by taking the matter before the NLRB received a setback in the President's statement confirming ALB jurisdiction over disputes in automobile plants. As a result the workers in a series of meetings which began Thursday will in reality have to decide whether they will (1) play with the A. F. of L. by keeping the dispute alive without calling a strike at this time; (2) abandon the A. F. of L. by accepting the verdict of the management or by taking the matter before the ALB; or (3) take matters entirely into their own hands by calling a strike.

It was expected that Thursday's meeting would defer an actual strike vote to a mass meeting Sunday, but Lansing reports indicate that the chance of avoiding a walkout are not regarded as too bright.

Union Workers at Bendix Vote to Accept Increase

Employees of the Bendix Products Corp. who are members of the A. F. of L. union affiliate within the plant have voted by seven to one to accept the company's proposal of a 5 per cent wage increase and the adoption of definite policies on working conditions. The union claims a membership of 3400 among the employees.

The corporation's proposal is immediately effective and, it is believed, has broken the tenseness which has gripped the plant for the past week with strike threats constantly present.

Champion Celebrates Silver Anniversary

The Champion Spark Plug Co. celebrated the 25th anniversary of its founding with a three day convention, attended by more than 100 members of the factory and field force. A company roll call revealed that three of Champion's salesmen have been with the firm 20 years or more; five from 15 to 20 years, and 52 from 10 to 15 years. Only seven men have been with the company less than one year.

R. A. Stranahan, president since the company's inception, pointed to the wide-spread acceptance of the company's product by stating that despite the "Buy British" campaign and high preferential tariffs in England, more than 80 per cent of English factory built cars are equipped with Champion plugs.

Novo's Business Gains

The Novo Engine Co. has reported that its January business in the manufacturing division increased 75 per cent over the corresponding month of last year.

AAWA Endorses ALB Principle

OK's Proportional Representation Plan

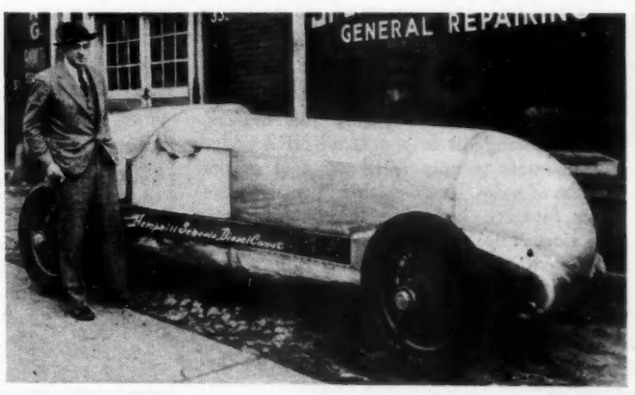
Virtually reversing the general labor union stand on ALB elections, in an exclusive statement to Automotive Industries, Arthur Greer, founder of the Associated Automobile Workers of America, a rival of the A. F. of L., endorsed the principle of proportional representation and indicated willingness to cooperate with the ALB in its elections at automotive plants.

Questioned as to the participation of his organization in the Hudson election Arthur E. Greer of the AAWA told a representative of AI: "We consider the present elections as a challenge to the workingmen to select the type of organizations which they wish to represent them. While we are not in full accord with the methods under which these elections are being held we do believe that all groups of workers have a right to express themselves as to the type of leadership they desire. From that standpoint the designation of affiliated representatives and the principle of proportional representation is also a challenge to the leadership of the various labor organizations representing groups of workers. If we can do a better job for the groups we represent than others do for their groups—if we can show capacity for leadership—acceptance of our organization by larger groups would follow as a matter of course. That is the reason why we actively participated in the Hudson plant elections."

A result of the fight which developed at last Sunday's mass meeting of Olds-Fisher body workers between the A. F. of L. and the AAWA has been the issuing of a new charter of the AAWA in Lansing to a group of workers at the Fisher body plant.

Dennis Gets Bendix Job

Col. Fred L. Dennis has been appointed Director of Highway Safety of the Bendix Products Corp., Frank B. Willis, sales director, has announced. Col. Dennis has been associated with the automotive industry for about 15 years. In June, 1934, he was appointed impartial agent for the national code authority of the retail tire and battery trade, and last November was made district manager for the Rubber Manufacturers' Association of New York.



Dave Evans and his "Hemphill Waukesha Comet," powered by a Diesel motor, with which he will try to establish a world speed record this month at Daytona Beach.

Canadian 1934 Registrations Up 3.3%

	Passenger Cars			Commercial Vehicles			Total Registrations		
	1934 No.	1933 No.	Change %	1934 No.	1933 No.	Change %	1934 No.	1933 No.	Change %
P.E.I.	6,429	6,153	+4.4	803	785	+2.3	7,232	6,940	+4.2
N.S.	34,483	33,133	+3.9	7,018	7,310	—4.0	41,501	40,443	+2.3
N.B.	25,082	22,890	+9.6	4,196	3,952	+6.1	29,278	26,842	+9.1
Que.	130,365	126,529	+3.0	34,921	33,483	+4.3	165,286	160,012	+3.3
Ont.	470,118	453,314	+3.7	66,884	67,039	—0.2	537,002	520,353	+3.2
Man.	59,300	57,930	+2.4	10,400	10,810	—3.8	69,700	68,740	+1.4
Sask.	73,772	69,040	+6.9	17,000	15,694	+8.3	90,772	84,734	+7.1
Alta.	73,114	71,076	+2.9	15,383	15,034	+2.3	88,497	86,110	+2.8
B.C.	73,219	71,439	+2.5	16,296	17,115	—4.8	89,515	88,554	+1.1
Yukon	130	121	+7.4	118	108	+9.2	248	229	+8.3
	946,012	911,627	+3.3	173,019	171,330	+0.9	1,119,031	1,082,957	+3.3

Note:—1934 figures preliminary, subject to slight change.

duPont to Test Products For Effects on Health

The Haskell Laboratory of Industrial Toxicology, established by the duPont company for the purpose of thoroughly testing, from the health standpoint, all duPont products before they are placed on the market, was opened Tuesday at Wilmington. Another function of the laboratory will be to test the possible effects of new products upon the health of employees during the manufacturing process.

The staff and equipment of the new laboratory are said to be the largest and most extensive of any organization of its kind in the world. Dr. W. F. von Oettingen, a graduate of the Universities of Jena, Goettingen and Heidelberg, is the director.

Highway Users Report on Motor Tax Participation

The National Highway Users Conference has issued in pamphlet form the results of a study it conducted into municipal participation in highway funds. The study is published in a pamphlet entitled "How Should Cities Share in Special Motor Taxes?" This subject has been covered in five principal sections: The Problem; City Streets; The Relative Motor Vehicle Use of Urban Streets and Rural Highways; What do Cities Receive from Motor Vehicles, and Considerations in a City Sharing Policy.

Dealers' Code Budget .0012% of Sales Volume

The cost of administering the dealers' code is among the lowest of all NRA codes and amounts to only .0012 per cent of the volume of sales. It takes this ratio with five other budgets, including the baking, construction, retail drug, general retail and investment bankers' industries. Eliminating these six budgets, the remaining 346 industries showed an operating ratio of 10/65 of 1 per cent, and the actual cost of administering all NRA coded industries is in the neighborhood of $41,400,000 a year.

These figures have been revealed by a special accounting unit under Hiram S. Brown, NRA Budget Director, after an extended analysis not only of the code authority budgets passed on by NRA but also of those pending.

Stewart, Lenz, Parker Flint Assoc. Officers

The Flint Manufacturers Association elected S. S. Stewart, president of the W. F. Stewart Co., president; Arnold Lenz, Chevrolet manufacturing manager, vice-president; E. J. Parker, Flint Fisher Body plants manager, was re-elected treasurer. The secretary is James Farber. The elections were held at the annual dinner and meeting in the Flint Club.

Members of the executive committee are F. S. Kimmerling, president and general manager of AC Spark Plug; Harlow H. Curtice, Buick president, and C. T. Scannell, general manufacturing manager for Buick.

N. J. Zinc Sales Co. Buys Ralph Potter Business

The New Jersey Zinc Sales Company has now purchased from the estate of Ralph E. Potter, who was associated with them for many years, the business and good-will of David Randall & Company, and will continue his business in the name of the New Jersey Zinc Sales Company. Until further notice the company will operate from the same Boston address (55 Kilby street) and through the same Boston warehouse. George W. Harragan, who assisted Mr. Potter while the latter was ill, will continue as New England representative.

Frisco Dealers Lose Less on Used Cars

San Francisco dealers reduced their gross trading losses to 14.38 per cent in 1934 of used car sales as compared with 20.71 per cent in 1933, 38.11 per cent in 1932 and 24.82 per cent in 1931, according to statistics compiled by their local trade association. The percentages are based on the difference between inventory value and selling price, and do not include expenses.

Tate Opens 2 Warehouses

Earl A. Tate, manufacturers' representative on the Pacific Coast for makers of replacement parts and accessories for motor vehicles, has opened two new warehouses. One is located at San Francisco and the other at Los Angeles. The lines being carried in these warehouses at the present time are those of the Simmons Manufacturing Co. of Cleveland, and The Armature Co., also of Cleveland. Prior to establishing the Earl A. Tate, Ltd., company 11 years ago on the west coast, Mr. Tate was Pacific Coast manager for the Klaxon Co. of Newark, N. J.

Phillips Joins Hastings Co.

Harold Phillips has joined the Hastings Mfg. Co., makers of piston rings, as chief of the engineering and research staff. Mr. Phillips entered the automotive industry with the Packard Motor Co. in the experimental machine shop division, later becoming production engineer for the Climax Engineering Co. Mr. Phillips was named president of Climax-Jones-Quinn, engine rebuilders, and as president of this company was active in the work of the Automotive Engine Rebuilders Association, being one of the charter members and serving it as secretary for the past three years. Prior to joining the Hastings company he was engineer for Sunnen Products Co.

CALENDAR OF COMING EVENTS

SHOWS

Kansas City, Mo. Automobile Show Feb. 9-16
Denver, Colo. Automobile Show..Feb. 10-23
Peoria, Ill., Automobile Show....Feb. 13-17
Bethlehem, Pa., Automobile Show. Feb. 18-23
Evansville, Ind Automobile Show.Feb. 23-27
Des Moines Automobile Show Feb. 25-Mar. 2
Minneapolis Automobile Show....Mar. 9-16
Mankato, Minn. Automobile Show Mar. 16-23
Machine Tool Exposition—Cleveland Sept. 10-21

ANNUAL MEETINGS

U. S. Chamber of Commerce Annual Meeting, Washington, D. C...Apr. 29-May 2
5th Annual Automotive Maintenance Meeting, Philadelphia .....March 5-8

CONVENTIONS

Lafayette, Ind. (Purdue University), Automotive Service Conference, Mar. 21-22

JUST AMONG OURSELVES

Code Extension a Courageous Action

THE President's courageous extension of the automobile manufacturing code in amended form should prove inspiring to business generally. It was not an easy thing to do in the face of the opposition of a minority as politically and economically powerful as the A. F. of L.

The outstanding developments in connection with the renewal of the code are, of course, the indorsement and continuance of the Automobile Labor Board and the authority given members of the industry to enter into an agreement intended to make employment more regular by concentrating new model announcements in the fall. The thought behind this plan is that the combination of stocking dealers and the stimulus new models give to sales should bulge the production curve upward in the fall when the trend has been downward. In addition, it is planned to build banks of parts in the fall and winter for assembly during the spring peak.

Effectuation of the plan is expected to bring larger average annual earnings for the individual worker and, in most departments, more stable employment. As to the effect on the annual volume, only experience will tell whether sales and the payrolls will be as large as with new model announcements around the first of the year.

The indorsement given the automobile settlement in the renewal order is evidence of the President's continued belief in the machinery for solving automotive labor problems which he commended so highly last year when it was created. This may have been a bitter pill for the A. F. of L., but it is difficult to see how the Federation could reasonably expect the President to do otherwise in view of the confidence automotive workers evidenced in the Board by their heavy balloting and the sorry showing of the unions in the elections. Despite this showing, the capacity of Federation unions to hamper automotive operations nevertheless must be recognized, since by concentrating their strength it is quite possible that they can exercise an influence that is far out of proportion to the number of workers on their membership rolls.

* * *

Bargaining Results Count

IT is conceivable that real collective bargaining might take place between an employer and an employee-agency that is not patterned along the traditional lines of an A. F. of L. affiliate. Some light should be thrown on this subject soon by the practical functioning of the works councils now being elected at various car plants under the supervision of the Automobile Labor Board.

If they do a satisfactory job for the workers, organizations of the A. F. of L. type could hardly be regarded as essential in industries such as the automotive. Perhaps it is because the Federation is fearful that they will do such a job, that it is not open-minded enough to want them to have a fair trial, even though it agreed to the plan at the outset.

Moreover, it is not clear on the strength of the ALB election returns what the Federation would gain if the majority rule doctrine of the Houde case were applied to the car plants, as the A. F. of L. insists it should be. Certainly the returns do not indicate that the Federation commands anything like the majority it would have to have to assume the dominant role in collective bargaining for which it apparently thinks it is cast.

* * *

Social Security and Inflation

SOCIAL security legislation now before Congress apparently is due for some modification before it is passed, but no matter what form it finally takes, it appears likely to have one important by-product that has had little or no attention. When a substantial proportion of all the gainfully employed are creating reserves to take care of them in their old age, they are going to have a collective stake ultimately in a fund that will run into tens of billions of dollars. Under such circumstances, it is reasonable to presume that they will take a practical interest in currency questions, and that any politician making proposals that threaten the integrity of the purchasing power of the dollar will be taking his life in his hands.

—The Editors

Laminated Sheets Give Sound

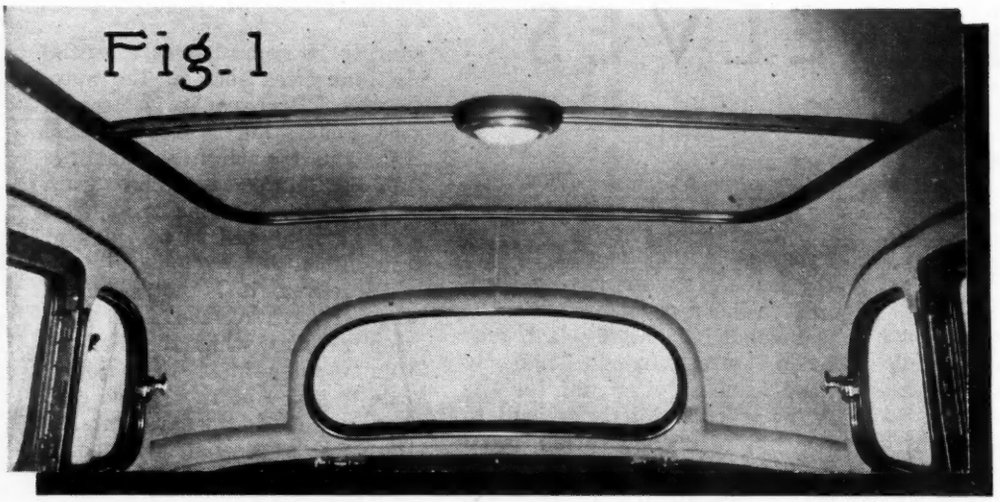


Fig. 1—Interior view of experimental body with separate steel roof section. Note the cleanness of interior treatment enhanced by the garnish molding covering the welded joints

THE advent of the steel roof on passenger car bodies of several production cars for 1935 is a matter of more than passing interest, for it permits the construction of truly all-steel bodies when built in combination with the steel under-body which is now almost common practice.

To many body engineers the steel roof will recall the early attempts at this design, hampered as they were by inhibitions of one kind or another, as well as the real difficulty introduced by various engine and chassis noises, body drumming, etc. Today these conditions either are non-existent or readily controllable. Body insulation effectively masks heat and cold and sound, while improved design and manufacture have served to quiet the chassis components.

It is interesting to learn that Joseph Ledwinka, E. G. Budd chief engineer, has been experimenting for some time with steel roof constructions which have been constantly improved in line with the advances in all-steel body technique. In fact a number of experimental cars have been built and operated to demonstrate the practicability of these steel roof designs.

Through the courtesy of the E. G. Budd Mfg. Co., we show in this article a number of steel roof designs evolved by Mr. Ledwinka for all-steel bodies. Each design has its own advantages depending upon the construction of the body, but in each case, emphasis has been placed upon low cost and simple welding procedure. For example, Fig. 1 shows an interior view in an experimental body, bringing out the cleanness of the steel roof job as well as the possibilities of interior treatment. This particular body is conventional and the steel section simply replaces the soft roof, thus offering the possibility of salvaging the present stampings.

Fig. 2 is a typical section at the roof joint, using a special laminated sheet spot welded along the lines indicated at "X." The space is filled in with dum-dum. The special feature of the design is the laminated sheet which is inherently "dead" and will not drum or vibrate. The head lining consisting of special felt fabric harmonizing with the upholstery fabric can be cemented directly to the inside metal surface. The built-up section around the joint adds rigidity to the deck and serves to damp vibration. The joint is finally covered with a suitable garnish molding. As shown in Fig. 1, an additional strip of garnish molding is applied to support the dome light. A rather important by-product of the construction is the use of the garnish molding as a conduit for the interior wiring.

It may not be generally known that Citroen used a steel roof on 1934 models which was designed by Budd and pressed with dies built in Philadelphia. The design is shown in Fig. 3, which features a simple lap joint spot welded along the edge. The joint is filled in with solder.

Recommended designs for new body models contemplate a steel roof construction in which the entire roof section is an integral part of the back panel. Two alternate methods are proposed. Fig. 4 shows the use of a single sheet stamping joined to the side panels along the entire length of the seams with a single row of spot welds, the joint being filled with solder.

The preferred construction is shown in Fig. 5. Here the combination roof and back panel is stamped from the special laminated sheet which is in-

Damping in Budd Steel Roof

by Joseph Geschelin
Engineering Editor, Automotive Industries

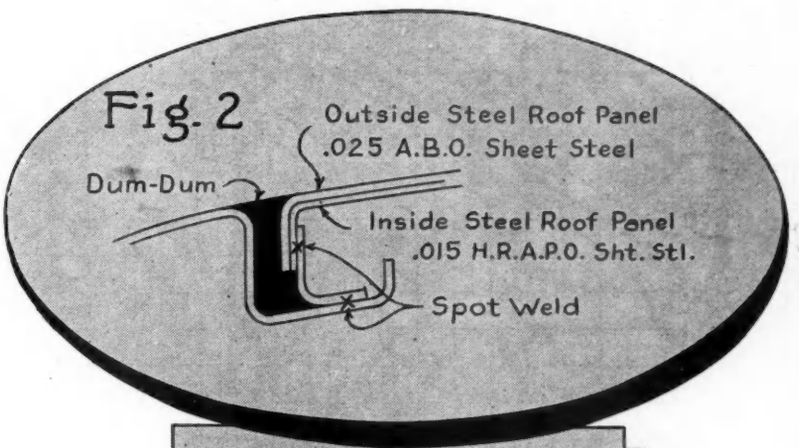
herently inert and rigid. The spot welds are made along the leg of the channel section and the joint filled with solder.

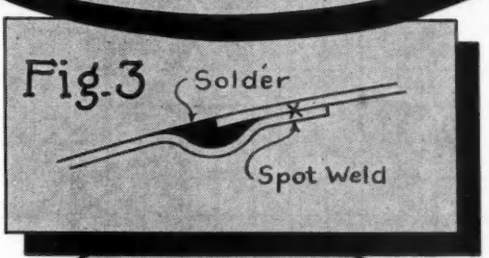
With quieter engines and chassis units as well as improved insulation methods the all-steel body is a very practical reality. It results in a better, stronger structure since the opening at the top is now covered with a material which serves as a load carrying member, strengthening the whole body.

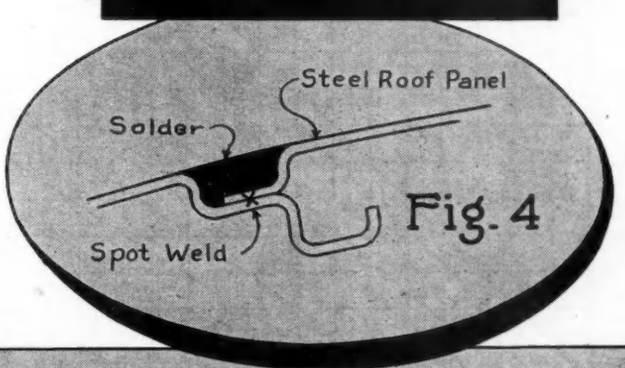
Interior treatment holds better possibilities under these conditions. The ceiling is set off by means of garnish molding while the head lining is smooth and clean since it may be cemented directly to the metal. In addition, the wiring is safer and easier to apply along the trim line.

Increased headroom without increasing the height of the car is another big feature. It is now possible to utilize the entire interior space through the elimination of roof ribs and the comparatively substantial thickness required by the soft roof.

Perhaps the most important element of the Budd construction is the use of a special laminated sheet for the roof and back panel stamping, thus providing an inherently "dead" material offering still greater protection against drumming.







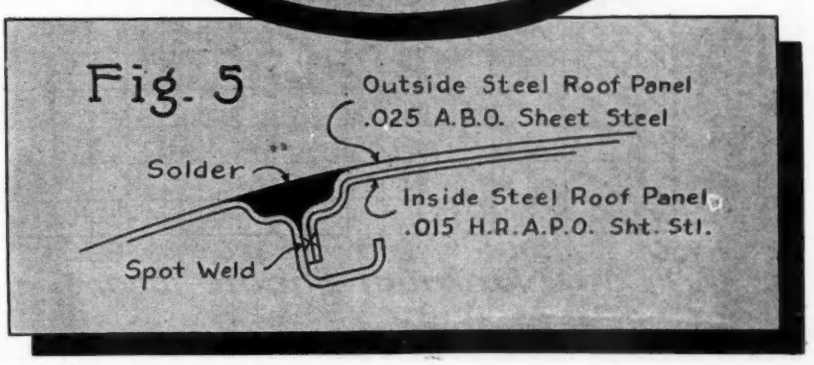


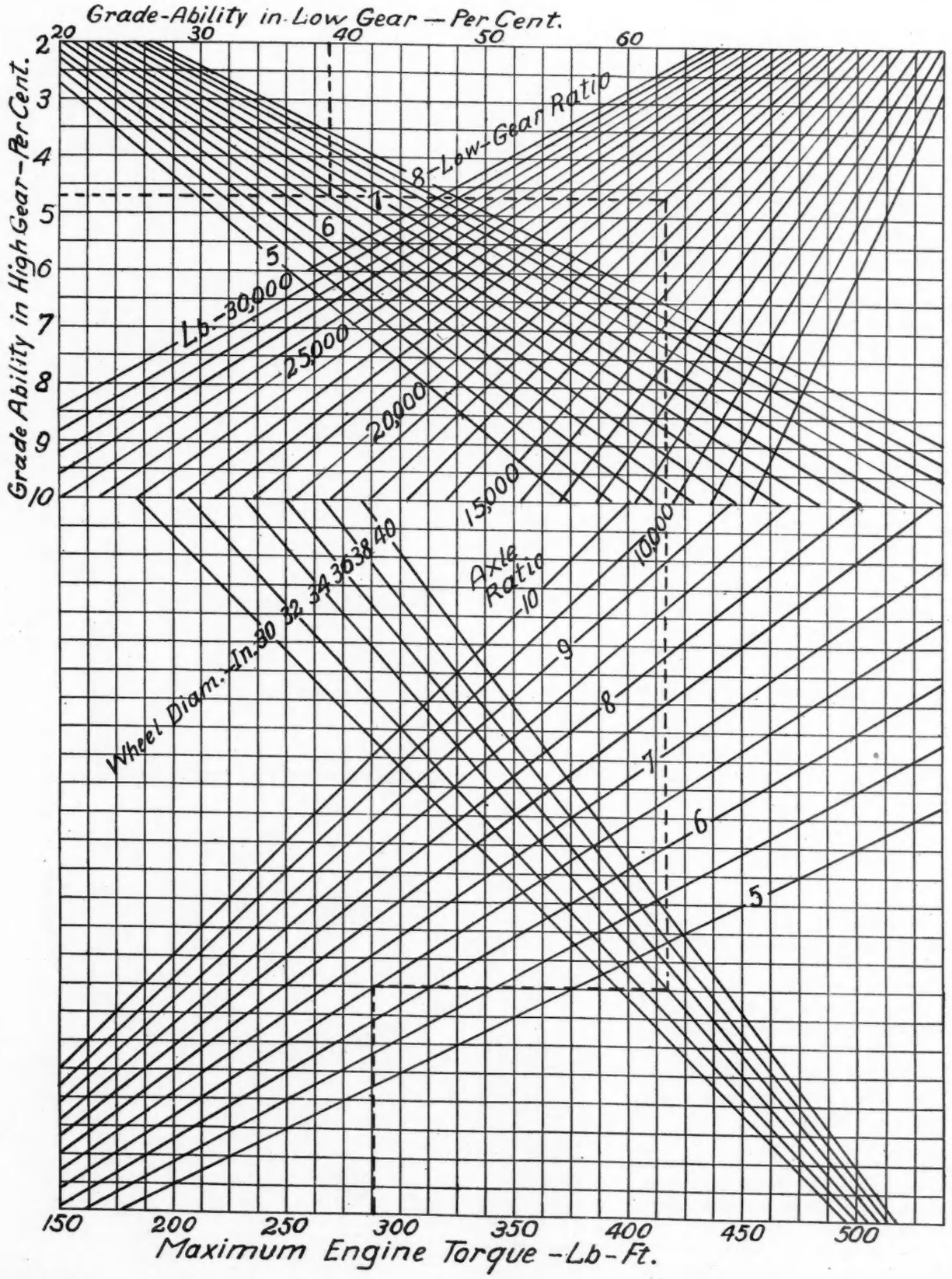
Fig. 2—Typical section at roof joint using the special laminated sheet construction developed by Budd

Fig. 3—Steel roof joint on Budd-designed Citroen body models

Fig. 4—Typical steel roof joint in which the roof is a part of the back panel stamping

Fig. 5—Recommended steel roof construction using the Budd laminated sheet for the unit roof-and-back panel stamping. No roof ribs are used in this form of design and the headlining is simply a special felt fabric which can be cemented directly on the metal.

GRADE-ABILITY CHART—



For Quick Determination of High and Low Gear Hill-Climbing Ability of Trucks

THE accompanying chart permits of determining the maximum grades which a truck of given characteristics will climb in both high gear and low gear, when loaded to its maximum gross weight. It is based on the equation,

$$A = \frac{T \times R \times 90}{r \times W} - 1.5 \text{ per cent},$$

where T is the maximum engine torque in lb-ft.; R, the final-drive ratio; the 90 in the numerator represents the assumed efficiency of 90 per cent of the drive from engine to road wheels; r is the effective drive-wheel radius in ft., and W the gross weight in lb. The 1.5 per cent in the equation represents the grade which offers a grade resistance equal to the rolling resistance on hard, level pavement.

In making use of the chart, locate on the scale at the bottom the point corresponding to the maximum engine torque, in lb-ft. This is usually obtained from a torque curve of the engine, but if such a curve is not available it can be found with sufficient accuracy from the equation

$$T_m = 6{,}750\ (hp/n),$$

where hp is the maximum horsepower of the engine and n the speed in revolutions per minute at which this horsepower is produced.

From this point on the scale at the bottom proceed vertically up to the inclined line representing the rear-axle ratio. From there pass to the right or left until intersecting the inclined line representing the wheel diameter. From this point pass vertically upward until intersecting the inclined line representing the gross vehicle weight. From there pass horizontally to the left to the scale on the left-hand side, where the maximum per cent grade which the vehicle will climb in high gear can be read off directly.

If it is desired to know also the maximum grade which the truck will climb with its full rated load in low gear, it is only necessary to pass from the point of intersection of the horizontal line indicating the grade-ability in high gear with the inclined line representing the low-gear reduction ratio in the transmission, vertically up to the horizontal scale at the top, where the grade-ability in low gear may be read off.

The dotted lines correspond to the example, what are the grade-abilities in high and low gears of a truck whose engine is capable of developing a maximum torque of 288 lb-ft., which has a rear-axle ratio of 8:1, wheels of 34-in. diameter, and a gross-weight rating of 19,000 lb. Calculated by slide rule the answers obtained are 4.75 per cent in high gear and 39 per cent in low gear, and it will be seen that the chart gives these results with a high degree of approximation.

The chart, of course, can be used also to determine the maximum engine torque required to give any desired high-gear or low-gear grade-ability when the gross weight, wheel size and rear-axle and transmission-low-gear ratios are known. In that case one proceeds backward, starting, for instance, with the desired low-gear grade-ability on the scale at the top, proceeding down to the point of intersection with the incline representing the transmission low-gear ratio, then horizontally to the incline representing the gross weight, then vertically down to the incline representing the wheel diameter, then horizontally to the intersection with the incline representing the rear-axle ratio, and from there vertically down to the scale at the bottom, where the answer may be read off.

Complete 1934 New Passenger Car Registrations

	December, 1934	November, 1934	December, 1933	12 Months 1934	12 Months 1933	Per Cent Change, 12 Mos. 1934 Over 1933	Per Cent of Total, Twelve Months 1934	Per Cent of Total, Twelve Months 1933
Chevrolet	25,756	36,807	10,003	534,906	474,493	+12.7	28.32	31.76
Ford	14,209	23,295	18,340	530,528	311,113	+70.6	28.09	20.83
Plymouth	11,903	13,482	12,176	302,557	249,667	+21.3	16.02	16.71
Dodge	3,968	5,496	4,363	90,139	86,062	+4.8	4.78	5.76
Pontiac	2,144	3,985	2,132	72,645	85,348	−14.8	3.85	5.71
Oldsmobile	2,146	4,819	866	71,676	35,295	+204.5	3.80	2.36
Buick	3,857	4,748	799	63,067	43,809	+43.8	3.34	2.93
Studebaker	2,113	2,512	2,826	41,560	36,242	+14.7	2.20	2.43
Terraplane	1,850	2,212	1,010	40,510	35,831	+13.2	2.14	2.40
Chrysler	1,348	2,435	669	28,052	28,677	−2.2	1.48	1.92
Hudson	902	1,030	79	19,307	2,946	+555.0	1.02	.20
Nash	663	1,022	1,537	14,315	11,353	+26.2	.76	.76
Graham	612	656	472	12,887	10,128	+27.2	.68	.68
De Soto	484	721	714	11,447	21,260	−46.7	.61	1.42
LaFayette	712	947	....	9,301	....	...	.49	...
Willys	253	308	564	6,576	15,314	−57.1	.35	1.03
Hupmobile	640	675	278	6,566	6,726	−2.4	.35	.45
Packard	481	599	360	6,552	9,081	−27.8	.35	.61
Auburn	383	450	198	5,536	5,038	+10.0	.29	.34
LaSalle	279	360	105	5,182	3,709	+39.7	.27	.25
Cadillac	259	395	120	4,899	3,903	+25.6	.26	.26
Reo	234	262	199	3,854	3,623	+6.6	.20	.24
Lincoln	97	187	111	2,061	2,112	−5.0	.11	.14
Pierce-Arrow	99	110	111	1,740	2,152	−19.1	.09	.14
Austin	88	94	117	1,057	3,675	−71.2	.06	.25
Continental	8	6	355	953	3,310	−71.2	.05	.22
Franklin	2	3	52	360	1,329	−72.9	.02	.09
Miscellaneous	24	32	68	324	1,598	−79.7	.02	.11
Total	75,514	107,648	58,624	1,888,557	1,493,794	+26.3	100.00	100.00
Chrysler Corp.	17,703	22,134	17,922	432,195	385,666	+12.3	22.89	25.81
Ford and Lincoln	14,306	23,482	18,451	532,589	313,225	+70.1	28.20	20.97
General Motors	34,441	51,114	14,025	752,375	646,557	+16.4	39.84	43.27
All Others	9,064	10,918	8,226	171,398	148,346	+15.6	9.07	9.95

1934 New Truck Registrations

	December 1934	December 1933	12 Months 1934	12 Months 1933	Per-Cent Change 12 Mos. 1934 Over 1933	Per Cent of Total—12 Months 1934	Per Cent of Total—12 Months 1933
Chevrolet	7,946	3,887	157,507	99,880	+57.7	39.00	40.62
Ford	6,374	4,517	128,250	62,397	+105.8	31.75	25.38
Dodge	4,656	3,200	48,252	28,034	+72.2	11.95	11.40
International	2,508	1,940	31,555	26,658	+18.3	7.81	10.84
G. M. C.	754	502	10,449	6,602	+58.5	2.59	2.68
Diamond T	365	282	5,440	4,139	+31.4	1.35	1.68
Reo	356	260	5,035	3,042	+65.6	1.25	1.24
White	253	117	3,963	1,384	+186.2	.98	.56
Federal	139	143	1,962	1,360	+44.3	.49	.55
Mack	98	146	1,830	1,652	+11.8	.45	.67
Studebaker	125	72	1,697	1,872	−9.4	.42	.76
Brockway	70	42	1,213	875	+38.8	.30	.36
Autocar	77	94	1,139	1,127	+1.2	.28	.46
Stewart	42	48	736	684	+7.7	.18	.28
Indiana	30	71	729	1,252	−41.8	.18	.51
Austin	44	62	494	1,053	−53.2	.12	.43
All Others	288	197	3,635	3,858	−5.8	.90	1.58
Total	24,125	15,580	403,886	245,869	+64.3	100.00	100.00

New Recording Method for Electric Engine Indicator Gives Positive Card Directly

by George T. Hemmeter
National Advisory Committee for Aeronautics

THE Farnboro type of electric engine indicator is perhaps one of the most widely used instruments for obtaining accurate pressure-time diagrams of high-speed engines. The mechanism of this instrument and the technique of taking indicator cards have been improved to such an extent that indicator cards of unquestioned usefulness in analyzing engine characteristics may now be obtained.

An inherent disadvantage of this type of instrument has been the method of recording. Heretofore records have been made by puncturing black opaque paper with high-tension electric sparks generated precisely when the cylinder pressure becomes greater or less than the auxiliary pressure which actuates the recording arm of the instrument. This punctured black record is similar in form to a photographic negative and is not suitable for direct examination or comparison with other records; to facilitate these operations, photographic contact prints must first be made. Aside from the usual loss of detail in copying the prints, they are further devaluated by the confusing light haze which filters through the natural pores of the record paper. If the paper is made more opaque by increasing its density or thickness, the spark intensity must be increased adequately to mark it, and the recording of weak sparking impulses will be completely obliterated.

In extending the general usefulness of the Farnboro type pressure-time recording instrument at the Langley Field laboratories of the National Advisory Committee for Aeronautics, the author has developed a new method of spark recording that eliminates the inherent disadvantages associated with the old method. Original records consisting of permanent black dots on white translucent paper are readily made using sparks of relatively weak intensity. As the markings are visible through the translucent card, the records can be examined for completeness before removing them from the instrument. Direct comparison between several of these cards can be made by superposing them. Reproductions can be made by blueprinting, thus eliminating the bother and expense of contact photography.

With the new method of recording a simple electrical hook-up similar to that shown in Fig. 1 is used. Breaking of the contact points at the interrupter valve energizes the secondary circuit of the spark coil. The resultant spark, which must have the proper polarity, is permitted to jump from the grounded conducting surface of a specially coated paper fixed to the recording drum, to the pointer electrode of the instrument. During the recording

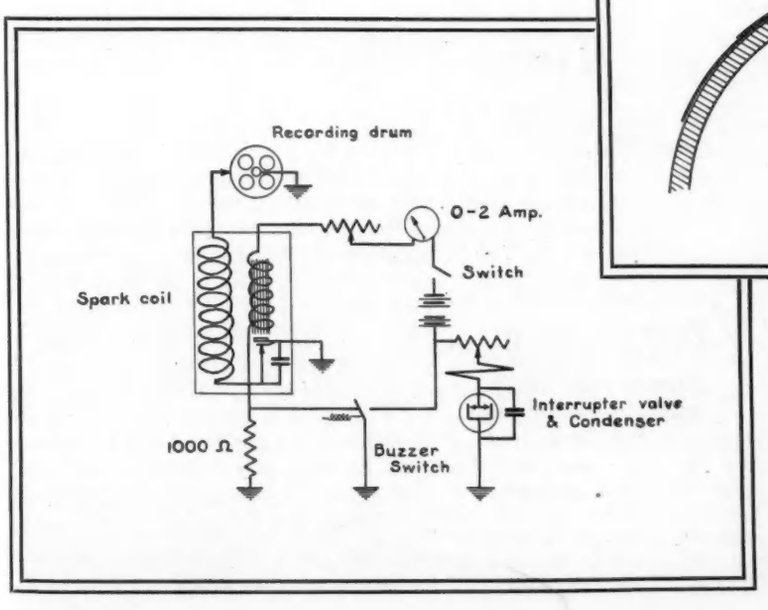


Fig. 1—Electrical hook-up for modified Farnboro indicator

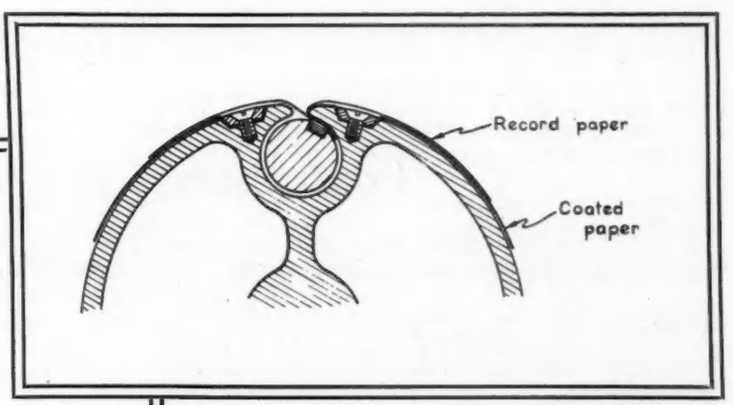


Fig. 2—Attachment of emulsion-coated paper to the recording drum

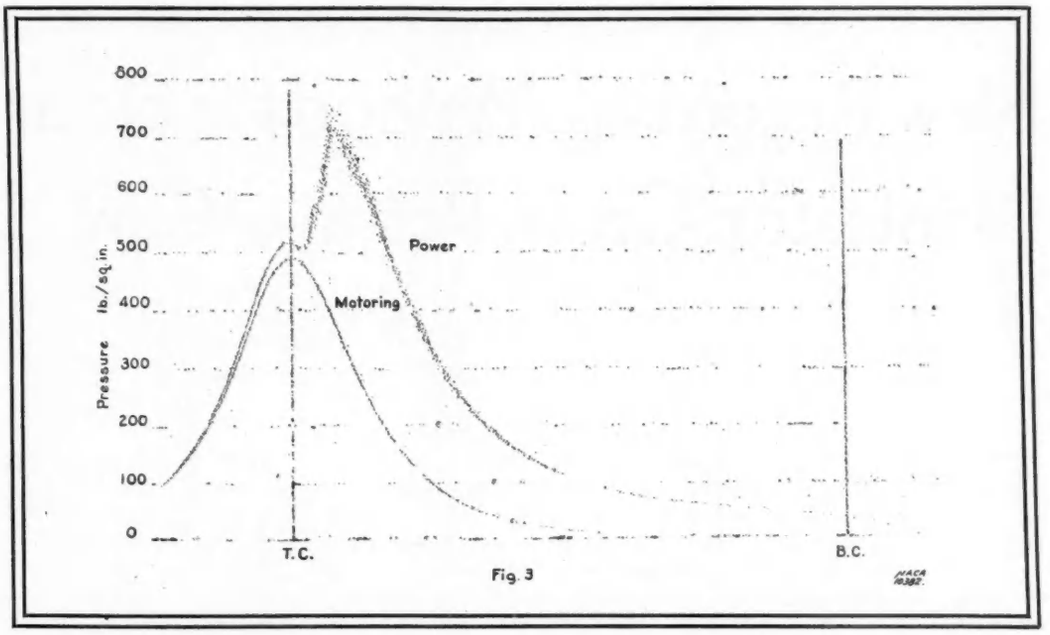


Fig. 3—Copy of a typical indicator card recorded by the new method

the record card is held in contact with the surface of the coated paper so that the spark must pass through it in jumping to the pointer electrode.

The emulsion used for coating is a composition of carbon, aniline dye, casein, beeswax, and talc and has the properties of supporting an electric arc, the arc being readily started by a weak-intensity electric spark of proper polarity. Thus when the spark jumps between the emulsioned surface and the pointer electrode, a carbon arc is started and the vaporized carbon particles liberated from the emulsioned surface flow to the pointer electrode. Some of the carbon particles are filtered from the stream as it passes through the record card, marking it at that point with a permanent black dot. As only a small area is affected by each spark, an indefinite number of cards may be taken with the same piece of coated paper.

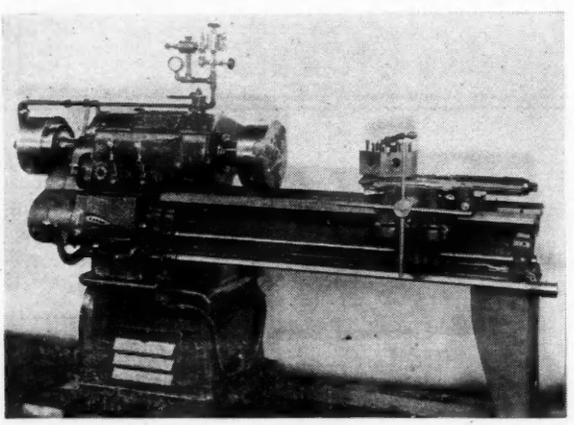
Fig. 2 shows the semi-permanent method used to fasten and electrically ground the emulsion-coated paper to the recording drum. The indicator-card record paper is fastened in the usual manner to facilitate changing.

The electric-arc method of recording offers several other important advantages of a secondary nature which are worth mentioning. The relatively thin open-pore recording paper which is suited for use with this system has a low dielectric strength and is therefore readily punctured by weak electric sparks. However, these sparks are of sufficient intensity to start arcing, and they adequately mark the card. The effect of decreased spark-intensity requirements is to diminish the destructive arcing and subsequent pitting of the primary circuit breaker points of the interrupter valve, and, in general, to simplify the design of the instrument and the electrical circuit. It is noteworthy that the system will not function with reversed polarity of the electrical circuit. This condition can be rectified by connecting a suitable condenser in series in the high-tension circuit.

Fig. 3 is a print of an indicator card taken on a compression-ignition engine using the new method of recording. The sharpness of the record will be noted.

Production Type Turret Lathe

A production type turret lathe of the sliding gear head design featuring eight speeds, has been introduced by Reed Prentice Corp., Worcester, Mass.



Production type turret lathe of the sliding gear head design made by Reed Prentice Corp.

In size it is 14 x 6 in. It is intended for certain production applications where the purchase of a more expensive machine cannot be justified.

Construction incorporates a standard eight-speed sliding gear headstock with self-contained cabinet leg motor drive and quick-change gear mechanism for feeds only. It is equipped with a power feed bed turret which incorporates both forward and reverse feeds for drilling and reaming operations in cast iron, mostly. The work is held in a 12-in.. three-jaw steel body combination air chuck operated through a 10-in. rotating double-acting cylinder with reducing valve and automatic lubrication unit.

AUTOMOTIVE ABSTRACTS

High Speed Two-Stroke Cycle Engines

TWO-STROKE cycle engines of the type using the crankcase as a charging pump make an economical powerplant in units of from one to three vertical cylinders of up to 20 cu. in. displacement each. These engines offer all that can be reasonably expected of them, aside from their poor idling characteristics, improvement of which constitutes the most important problem connected with their further development. For a cheap mass-production car, this type of engine, with perhaps three cylinders of an aggregate displacement of 61 cu. in., is eminently suited.

A modified form incorporates an auxiliary piston in a cylinder open to the crank-chamber, to increase the pumping capacity of the crankcase. This engine can be built to have a symmetrical port opening diagram, but a non-symmetrical diagram is preferable, as this permits of supercharging. Two-cylinder engines of this design, with up to 46 cu. in. total piston displacement, are particularly suited for high-efficiency types where scavenging expenditures of up to 1.5 and even more may be involved, in the case of "sports cars."

A single-acting piston-tpye charging pump is of value only in connection with Diesel and other injection-type engines. In the case of two and four-cylinder engines the V arrangement is superior to the in-line arrangement, on account of both the higher charging efficiency and the better mechanical balance obtainable. One very attractive arrangement consists in two horizontal opposed working cylinders with their pistons connected to a central crank, and a charging cylinder adjacent to each working cylinder, the piston of each of which is connected to a crank directly opposite the central crank. It is also possible to place the charging cylinders either at a right angle or at an oblique angle to the power cylinders, these latter being of the U type arranged transverse to the crankshaft. The primary advantage of the combination involving a single-acting charging cylinder is that it permits of building either single-bank or multiple bank radial engines.

With symmetrical port-action diagrams (exhaust port opening ahead of and closing after inlet port) the charging expenditure must not exceed 0.7 for stock engines and 1.0 for sports engines, while with unsymmetrical port-action diagrams these values must not exceed 0.95 and 1.25 respectively. In engines in which only air is compressed the values naturally may be considerably greater.

Practically all lay-out difficulties can be solved in a simple manner if a rotary blower is provided. With such blowers it is possible to build in-line engines with excellent dynamic balance and short V or X engines, the former in some cases with two cylinders firing simultaneously, the latter with uniform firing intervals. Besides, all technical difficulties connected with charging and charge distribution are eliminated. The multi-cylinder (preferably six-cylinder) in-line engine, aside from the radial type with which even greater outputs are obtainable, represents the best general solution of the high-speed two-stroke-engine problem. This type has the further advantage that it can be developed in U-cylinder form without difficulty, which for the present is the only practical type giving unsymmetrical port action.

The blower required—which still remains to be developed—must have a volumetric efficiency up to 1500 r.p.m. equal to that of a good piston-type pump, and at higher speeds the volumetric efficiency of a rotary piston blower. It must be capable of operating at speeds up on 5000 r.p.m. and its isothermal efficiency must not drop below 0.35 even in the case of moderate counter pressures. The efficiency curve for delivery at atmospheric pressure should peak at as low a speed as 800 r.p.m. and with increase in counter-pressure the most economical speed should increase 300 r.p.m. for every one-tenth atm. Blowers at present available do not meet this requirement.

At the present time the four-stroke engine properly controls the field of more than 61 cu. in. displacement. It is not likely that it will be entirely ousted from the range of displacements between 75 and 150 cu. in., especially so far as the four-cylinder engine is concerned, which is hardly any more expensive to manufacture than an equivalent two-stroke engine and has the advantages over the two-stroke that it is smoother in operation, idles better, and consumes less fuel. This type has returned to popularity in recent years as a result of the introduction of floating mountings. From the foregoing it would seem that the high-speed two-stroke engine were destined to control the fields of very small and very large outputs, as is the case in the stationary-engine field.

As regards the high-speed two-stroke engine of the fuel-injection type—which should be developed much more energetically—crankcase charging needs not to be considered, on account of the large demand for air. For operation on producer gas the use of crankcase charging is likewise out of the question, because of the smudging of the crankcase by the tarry material carried along by the gas. From this point of view also there is an urgent need for a rotary blower that would show high efficiency even at low speeds, that could deliver against counter-pressures up to one atmosphere, and that would be reliable at speeds up to 5000 r.p.m., a high isothermal or adiabatic efficiency being assumed.

The article of which the foregoing is a summary forms an extensive treatise on the general lay-out of high-speed two-stroke engines that is illustrated by 50 diagrams and mechanical drawings. Dr.-Ing. J. Herbert Venediger, *A.T.Z.*, Oct. 10 and 25.

Single Sleeve Air-Cooled Radial

A SINGLE-SLEEVE valve, air-cooled radial aircraft engine has been produced by the Bristol Aeroplane Company. This type of engine lends itself particularly well to supercharging and has the additional advantage over poppet valve engines that it embodies a much smaller number of parts, so that the production costs should be lower.

Ricardo's experiments on compression-ignition engines of the sleeve-valve type also have been crowned with success. A two-stroke, single cylinder unit of this type has passed a 50-hr. test, and there are some prospects of its development as

an aircraft engine. Experiments have been made with an engine of this design in which the intake pressure was raised to 3½ atmospheres by supercharging. Further investigations in connection with the development of fuel-injection pumps for gasoline engines are in hand although experiments at Farnborough indicate that equally good results as regards fuel economy and full-throttle performance can be obtained with carburetors. Ice formation in the latter, which has been put forward as a factor in favor of injection, can be prevented by comparatively simple means.—Report of the Aeronautical Research Committee for 1933-4. H. M. Stationery Office, London.

Motor Horns, Effective and Offensive

A MOVEMENT has been started in England to reduce the noise incident to street traffic, and in connection therewith a number of papers on noise reduction in motor cars were read at the recent meeting of the British Association. One of these, by E. O. Turner, dealt with "Motor Horns, Effective and Offensive." Mr. Turner outlined the development of the motor horn from the old bulb horn to the latest type of motor horn. He also discussed the type of note to be preferred, with the aid of oscillograms of the signals emitted, and legislation relating to the blowing of horns in different countries. Recommendations made in the paper are summarized as follows:

Horns must blow a strictly periodic note, without appreciable delay after operating the push.

The note should have a fundamental low pitch, with one or more strong overtones, the highest not exceeding 3000, the loudness not exceeding a prescribed figure.

Auxiliary horns of higher pitch and greater loudness may be fitted, but for country use only.

Single staccato signals in place of sustained notes are advocated whenever possible.

In towns, during the day, horns should be blown only in case of danger, and not merely to maintain speed.

During the night horns should not be used at all; recourse may be had to the dipped headlamp beam or other similar optical signal, speed being reduced where necessary to insure safety.

The complete paper appears in *Engineering* of Oct. 26.

Hydraulic Transmissions

AUTOMATIC functioning of a variable transmission may be an occasional advantage, and the introduction of this feature should not present any serious difficulty. In general it is undesirable, however, and the position that this should be an inherent feature is an entire fallacy. Indeed, a variable transmission which cannot be held at any desired condition fails to provide a complete solution. Control must be simple, easy, foolproof and maintainable under all conditions of service. Reversion to a stationary part must be provided, since the input mechanism cannot take any reaction exceeding that of input torque. Accomodation for torque augmentation must therefore be provided by separate means.

Although the problem is fenced with difficulties, approaches to it are numerous, the best advances having been made by hydraulic types. Following are some points in connection with the design of hydraulic transmissions which are the result of experience:

1. Idle fluid must be reduced to a minimum. Fluid circulation must be as natural, easy and short as possible. Flow must be full, continuous and free from obstructions and undue changes throughout the whole circuit. Freedom from velocity changes, except at reaction stages, is of much importance, since they involve pressure changes accompanied by loss of energy and control. Action and reaction must be in close proximity consistent with working clearances. Parts moving relative to each other should be separated by an oil film of up to 0.025 in. depending on location. Neglect of this may lead to serious frictional loss.

Physical and chemical properties of the working fluid require careful balancing. Good lubricating quality, lasting body, freedom from acid, air and emulsification are important. The congealing point and coefficient of friction must be low, while the boiling point, flash point and specific heat must be high. Sperm oil, winter grade, has proved the most satisfactory working fluid under prolonged and exacting road tests. The properties of this oil are as follows:

Specific gravity, 0.88 at 59 deg. F. (55 lb. per cu ft.); absolute viscosity, 0.42 dynes per sq. cm. at 59 deg. F. to 0.05 dynes at 212 deg. F.; coefficient of friction, 0.004 under normal conditions; setting point, 23 deg. F. can be obtained; open flash point, 392-446 deg. F.; specific heat, 0.35-0.40; unsaponifiable matter, 39-42 per cent; iodine value, 70 to 90; saponification value, 124 to 144; acid value, 1.5 per cent max.—Jesse Bedford in *I.A.E. Journal* for October.

Safety Glass and Substitutes

SEVERAL different kinds of safety glass or substitutes are being offered in Germany to replace plate or window glass for use in automobile bodies, with a view to eliminating the dangers of broken glass in the event of a crash.

"Artificial glass" is a glass substitute possessing greater elasticity than silicate glass and does not sliver under any conditions. Glasses of this kind, however, are not nearly as hard as natural glass, and their transparency decreases in the course of time as a result of dust-abrasion, cleaning operations, etc. The material used is usually acetylcellulose (cellon plates) or synthetic resins. A representative of this type of glass is Plexiglass which is claimed to be weatherproof, not to fade, and to be materially harder than cellon or celluloid.

A single layer or non-laminated safety glass is known as Securit. This consists of a sheet of plate glass which after having been brought to its final form is heated in special ovens to near its softening temperature and is then rapidly cooled. This hardening process is said to produce internal strains, so that in case of a crash the glass does not fail at the point of impact but breaks up completely into "crumbs" which, however, remain in place. The manufacturer claims that the glass remains transparent after being thus crushed, but the degree of transparency naturally is greatly reduced. This "hardened" glass cannot be cut and must be in its final shape before being subjected to the hardening process.

The usual safety glass for automobiles consists of three layers, two outer layers of plate glass and a central layer of a material which does not shatter. The intermediate layer consists of a cellulose ester as a rule. This material is subject to attack by atmospheric agencies, and to prevent such attack, the edges of the plate must be sealed.

For a number of years development work has been done on safety glass with intermediate layers of polymerization products of organic compounds, that is, synthetic resins. This material is weatherproof and the edges need not be sealed. In one of these new glasses, known as Peka laminated glass, the intermediate layer of synthetic resin is quite heavy and the material has an exceptionally high bulk modulus, which is said to increase the safety factor. Fractures of the skull due to collision with such a glass are said to be impossible.—*Allgemeine Automobil Zeitung*, Aug. 25.

New Models in Fall Urged in Henderson Report; Labor Conditions Criticized

(*Continued from page* 161)

hour limitations accorded employees earning more than $35 weekly should also be amended to apply only to executives. Further, it is recommended that the code labor provisions be coordinated with those in the automotive parts and equipment code, and in the special tool, die and machine shop code.

Much of the workers' dissatisfaction would disappear, the report holds, if annual incomes were high again. "Annual incomes for workers can be made relatively high, regardless of volume, by granting the same degree of attention as is now accorded hourly rates," the report concludes although what this rather cryptic statement means is not clear.

In its final recommendation, the report says "Many of the complaints against management—such as poor working conditions, terror, and discrimination—will disappear when and if facilities are fully extended 'for the purpose of collective bargaining or other mutual aid or protection.'"

The report urges more planning by the industry itself in the interest of high annual incomes and security; emphasizes the need for "coordinated reforms of sales and purchasing methods to relieve the destructive pressure on dealers and automotive parts manufacturers"; and charges that labor unrest, to a degree not warranted by the depression, exists due to insecurity, low annual earnings, inequitable hiring and rehiring methods, espionage, speed-up and the displacement of workers at an extremely early age. It also points to the wide gap that has grown up between management and workers due to the responsibilities placed on the foreman, but mentions that some companies are striving to close this gap.

While ALB lay-off rules have yielded some improvement, the report says the workers do not understand them. Moreover, seniority only applies to a particular plant and, if a worker goes elsewhere for a job, he is classified as a new worker.

A tabulation of the percentage of the year's total man-hours worked in each of eleven months in 1934 shows:

January	7.73	July	8.34
February	9.30	August	7.09
March	11.93	September	5.97
April	12.07	October	5.37
May	9.97	November	5.44
June	9.27		

Indications of what might be expected if production and employment were regularized, and new models announced in the fall have been estimated by the manufacturers. A month by month tabulation pictures a possible production year in terms of employment according to the report, as follows:

Month	Percentage of Total Employment	Hours per Week
October	60	40
November	100	40
December	100	40
January	100	36
February	100	40
March	100	40
April	100	48
May	100	48
June	100	40
July	100	36
August	100	36
September	100	26

"Annual incomes vary greatly from plant to plant," the report states. "The Packard Motor Car Company, which for years has been actively endeavoring to eliminate seasonality from its employment, shows the result of continued effort in this direction by having one of the best records of stable employment in the industry. In 1934, 92.8 per cent of its workers were employed in at least 40 weeks of the year, while 76.3 per cent were employed in 50 or more weeks. The annual earnings in 1934 of 53 per cent of this company's workers exceeded $1,200. Contrasted with this is another company which had only 30.6 per cent of its workers employed in 40 weeks, and 11.5 per cent employed in 50 weeks or more, while 27.4 per cent of the workers were employed in less than 14 weeks of the year. The annual earnings of only 23 per cent of the workers employed by this company in the peak month were equal to $1,200, while 32 per cent of its workers earned less than $400 while employed by it."

January Output Tops 300,000

(*Continued from page* 161)

The highest January world production of Ford cars and trucks since 1929 was reported this week by the Ford Motor Company, a total of 105,230 units having been produced during the past month. This represents an increase of more than 70 per cent over world production in January, 1934, when 61,813 units were built. The world production for January of this year is the largest for a comparative month since January, 1929.

Pontiac retail deliveries for January totaled 7390 sixes and eights, exceeding any January since 1928 and four times the figures for last January. Unfilled orders on Feb. 1 were 8566 ahead of orders for Jan. 1. January shipments were 1586 compared with 232 last January.

Packard reports production schedules on the new 120 series of 2000 cars for February and 4000 for March.

Deliveries of Plymouths and Dodges by Dodge dealers for January are the highest for the organization for that month in its history, with 16,350 cars and 3404 trucks and commercial vehicles delivered at retail, more than doubling the figures for last January.

Graham-Paige shipments for January and up to Feb. 5 total 2100 cars with production now over 200 cars daily. Orders to date total 5700 cars and employment is over 30,000.

Buick reports retail deliveries during the last 10 days of January were 50 per cent ahead of the second 10 and totals for the month are ahead of January of last year.

Plymouth reports retail deliveries for January of 24,000 cars compared with 8000 last year. Shipments for the month broke all records in company's history with 48,696 cars shipped to dealers. Production is approximately 2000 cars daily now with dealer orders to date exceeding 125,000 cars it is stated.

Chrysler dealers report retail deliveries for the first five weeks of this year of 1875 Chrysler cars in addition to 9516 Plymouths, the Chrysler car sales alone representing a more than quadrupling of last January's sales.

Cadillac retail deliveries, exclusive of LaSalle, for January are 52 per cent ahead of the same month a year ago. Including LaSalle deliveries are more than double the same last period year.

Factory shipments of Nash and LaFayette cars during January were the largest of any January since 1929, according to C. H. Bliss, vice president and director of sales. Production schedules for both the Racine and Kenosha plants, Mr. Bliss announces, will be higher than they were during February, 1934.

D. E. Ralston, vice president and general sales manager of Olds Motor Works has reported that in January more cars were built than during the first two months of 1934 combined. By the end of February, the statement said, Olds production will be three and one-half times that of the same period last year.

Orders for 1935 Hupmobiles are now higher for this time of year than in many seasons, the company has more than three times as many orders on hand as at the same time a year ago. Orders have exceeded shipments by over 1300 cars during the past month.

Toledo Pay Increases Stall Labor Troubles; Pittsburgh Plate Glass Strike Ends

(*Continued from page* 165)

from cutting orders and reducing employment.

A few days ago workers in the Libby-Owens-Ford Glass Co., where wages averaged 71 cents an hour, made a settlement of a flat 5 per cent increase and a general adjustment involving about 2 per cent on the general payroll.

With these settlements affecting nearly 9000 workers chiefly engaged in automotive parts production, it is believed Toledo's labor problems are well in hand.

The strike of Pittsburgh Plate Glass Co. employees ended at midnight Monday, when the company granted the workers a 5 per cent wage increase, but refused to allow the check-off request. A new contract was signed which will expire some time next fall. The contract, it is reported, may be opened by either side on 30 days' notice. Operations were resumed immediately and both the Pittsburgh company plants are now in full operation.

Meteor Motor Car Co.

A net loss of $9,779 for 1934 is reported by the Meteor Motor Car Co., which compares with $5,618 for the previous year.

Fig. 1—Diagram of blower with diffusor

Demand for A Stimulates I

A discussion of the problems involved in the design of turbo-blowers and their advantages on Otto and Diesel cycle engines

CENTRIFUGAL supercharging is a quite familiar subject, so far as its general theory is concerned, and many designs of supercharger have been illustrated in *Automotive Industries*. However, the theory and design of impellers, diffusors, vanes, etc., with which the designing engineer must be acquainted, are not sufficiently understood, and in the past improper design in some cases has led to failure and tended to discredit the application of turbo blowers.

Today the possibilities of superchargers are greater than ever, because of the growing demand for increased power and reduced weight in all fields of engine application, and because the size of the engine, especially that of engines in passenger cars, appears to be too large in view of the present economic situation. In the case of compression-ignition engines, supercharging combined with scavenging results in an even greater proportional increase in power output than supercharging alone. From the standpoint of production economy it is of great importance that the output of a given engine can be changed to suit changed or special conditions without radical changes in the engine, by simply changing the degree of supercharge, for supercharging is the most effective and flexible method of increasing engine output.

A turbo blower consists of an impeller rotating in a stationary case. Gases receive energy from the vanes, with resulting increase of angular momentum, pressure, and velocity. A large part of the energy of the gas at discharge from the impeller is kinetic and must be transformed into pressure. This change is accomplished by a diffusor (Fig. 1), a whirlpool chamber (Fig. 2), or a spiral case (Fig. 3).

Really efficient conversion of the kinetic energy can be accomplished only by means of a diffusor with curved guide vanes. These must provide channels of gradually increasing section, to reduce the gas velocity and transform the velocity head into a pressure head. The spiral case is a spiral-type housing which reduces the gas velocity gradually. The whirlpool chamber consists of a ring surrounding the impeller; the gas enters this space at great velocity, and as it approaches the outer circumference its velocity gradually diminishes while its pressure simultaneously increases. The whirlpool is surrounded by a circular—or, better, a spiral—case. This construction increases the size of the blower more than the diffuser, because the outside diameter of the whirlpool must be considerably larger than the inner diameter, otherwise the pressure transformation will not be effective, and the efficiency of the whirlpool is not very high in any case. Turbo blowers are built in single-stage and multi-stage (Fig. 4) forms.

Rotative speeds of blowers are usually quite high, about 24,000 r.p.m. for passenger cars and 30,000 r.p.m. or more for racing cars; for airplane engines the speed is usually from 10,000 to 12,000 r.p.m. These blowers are of improved multi-stage design, with efficient diffusors, which makes them reliable and efficient in operation.

Referring to Fig. 5, the following notations will be employed in our discussion. For the impeller:

- v, absolute velocity of gas;
- w, relative velocity;
- u, linear velocity;
- r, radius;
- s, tangential component of velocity v;
- f, radial velocity;
- j, width of channel in axial direction;
- k, unit weight (which can be considered constant for small compressions, the average value being used);

More Power and Less Weight Interest in Superchargers

By Joseph Jandasek, M.E., E.E.

l, area of current normal to f;
m, mass of gas flowing per second;
q, pounds of gas per second;
n, r.p.m.;
p, pressure;
h, pressure head;
H^1, total head at a point in the blower;
t, torque;
x, angle between v and u at entrance;
β, entrance vane angle;

Head may be defined as the amount of energy per unit weight of fluid. The total head at any section will be given by

$$H^1 = p/k + v^2/2g + z, \quad (2)$$

while the pressure head is

$$h = p/k. \quad (3)$$

When the blower is standing still the pressure at all points is the same (neglecting the elevation), but when the machine is operating the pressure head h at any point is smaller than the total head H^1 by an amount equal to a velocity head ($v^2/2g$).

Therefore, neglecting elevation head and friction losses, for a point just ahead of the impeller entrance we have a total head

$$H_i^1 = H_i + V_i^2/2g$$

where H_i is the pressure head and V_i the gas velocity in the suction pipe.

As no energy was added between the suction pipe and the impeller inlet, we have (for a point immediately ahead of the impeller)

$$H_i^1 = h_i + V_i^2/2g \quad (4)$$

For a point just inside the impeller inlet the relative total head is $h_i + w_i^2/2g$, and for a point just inside the impeller exit, $h_o + w_o^2/2g$, w being the velocity relative to the rotating impeller.

While the gas passes through the impeller channels its pressure is increased by $(u_o^2 - u_i^2)/2g$, due to the centrifugal force; therefore

$$h_i + w_i^2/2g + (u_o^2 - u_i^2)/2g = h_o + w_o^2/2g \quad (5)$$

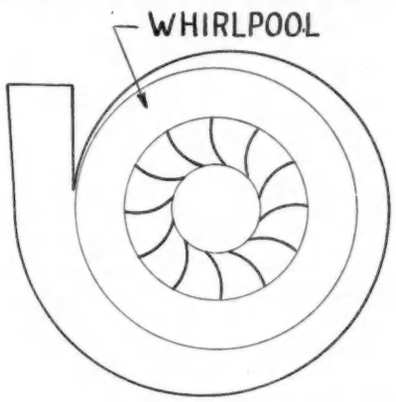


Fig. 2—Diagram of blower with whirlpool chamber

γ, outlet vane angle;
δ, angles between v and u at outlet;
g, acceleration of gravity;
ω, angular velocity;
η, efficiency.

Subscript (i) refers to the stream at the inlet; subscript (o) to the stream at the outlet. For the guide wheel (Fig. 6) the same notation in capitals will be employed.

According to Bernoulli's theorem, a particle of fluid may be capable of doing work by virtue of its pressure p, its velocity v, or its elevation z. The expression for its total energy is

$$p/k + v^2/2g + z = \text{constant}. \quad (1)$$

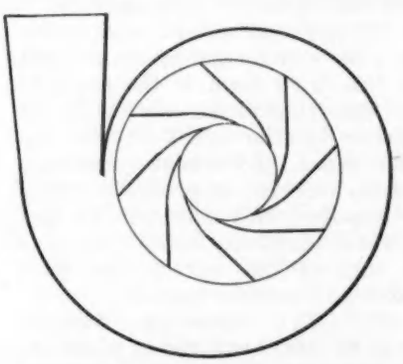


Fig. 3—Diagram of blower with spiral case

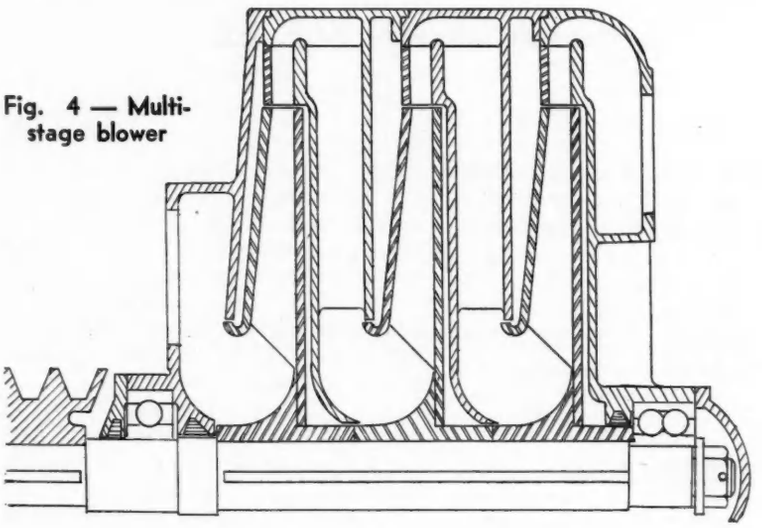


Fig. 4 — Multi-stage blower

where

$$(u_o^2 - u_i^2)/2g = h_c \qquad (6)$$

h_c being the increase in pressure due to centrifugal force.

At the impeller outlet the total head is equal to $h_o + v_o^2/2g$, and this must be equal to the total head at the entrance to the guide vanes, $H_i + V_i^2/2g$.

As no energy is added to this fluid in the guide wheel, the total head at the entrance must equal the total head at the outlet; that is,

$$H_o + V_o^2/2g = H_o^1,$$

and, finally,

$$h_o + v_o^2/2g = H_o^1 \qquad (7)$$

Adding equations (4), (5) and (7) we get the fundamental equation

$$\frac{v_o^2 - v_i^2}{2g} + \frac{u_o^2 - u_i^2}{2g} + \frac{w_i^2 - w_o^2}{2g} = H_o^1 - H_i^1 \qquad (8)$$

The first term of this equation represents the velocity head which must be converted into pressure in the diffuser; the second term represents the centrifugal-pressure head, and the third term is the pressure head imparted to the gas inside the impeller by the effect of the impeller vanes. Divergent vanes produce an increase in pressure within the impeller. We may call the first term the dynamic head, H_{dyn}, and the sum of the second and third terms the potential head H_{pot}.

$(H^1_o - H^1_i)$ represents the increase of total head and is made use of in the calculation of centrifugal blowers; it is a theoretical value, as it disregards losses. The effective head then is

$$H^1 = \eta(H^1_o - H^1_i) \qquad (9)$$

From the velocity diagram (Fig. 5) we get

$$w_i^2 = u_i^2 + v_i^2 - 2u_i v_i \cos \alpha \qquad (10)$$

$$w_o^2 = u_o^2 + v_o^2 - 2u_o v_o \cos \delta \qquad (11)$$

Substituting in equation (8) we have another form of fundamental equation

$$u_o v_o \cos\delta - u_i v_i \cos \alpha = g\,(H_o^1 - H_i^1), \qquad (12)$$

and since

$$s_o = v_o \cos \delta$$

and

$$s_i = v_i \cos \alpha \qquad (13)$$

$$u_o s_o - u_i s_i = g(H^1_o - H^1_i) \qquad (14)$$

It is interesting to note that the total head of a centrifugal machine depends only on velocities and not on the fluid pumped; that is to say, a machine will develop the same head whether it is pumping mercury, water, or air, provided the velocities are the same.

If no rotation were imparted to the gas up to the inlet edge of the impeller, α would be equal to 90 deg. and equation (12) would become

$$u_o v_o \cos \delta = u_o s_o = g(H_o^1 - H_i^1) \qquad (12a)$$

Fig. 7 illustrates the influence of the impeller discharge angle γ on the total head. It follows from equation (12a) that the total head increases with the angle γ, u and f remaining the same. Both H_{pot} and H_{dyn} increase with angle γ, but H_{dyn} is very small for small angles γ, which explains why turbo machines with backwardly curved vanes are more efficient. In them a greater percentage of the energy is changed into pressure energy by the impeller and only a relatively small portion needs to be changed by the guide vanes. When γ is equal to 90 deg., u_o is equal to s_o and

$$H_{dyn} = H_{pot} = u_o^2/2g$$

Equation (12a) then becomes

$$u_o^2 = g(H_o^1 - H_i^1) \qquad (12b)$$

One half of the energy imparted to the gas by an impeller with radial vanes is pressure energy; the other half, kinetic energy. This latter also must be converted into pressure energy, or it will be lost (position C in the diagram).

Forwardly inclined impeller vanes are seldom used, because most of the energy imparted by them is in the kinetic form and its transformation always involves losses. In any case, it is imperative that the kinetic energy be transformed efficiently. The velocity must be reduced gradually; the guide channels should be designed with a gradual increase in cross-section, and they should be sufficiently long and very smooth. If guide vanes are not used, the discharge velocity v_o will be reduced suddenly to whatever velocity there is in the discharge pipe, and the kin-

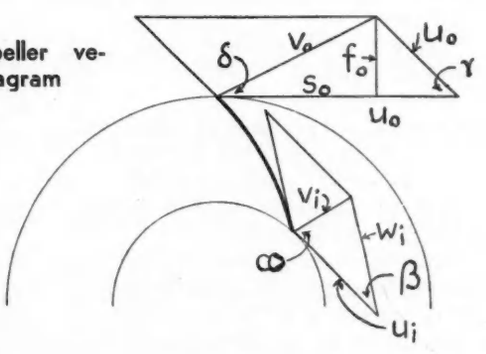


Fig. 5—Impeller velocity diagram

etic energy $v_o^2/2g$ will all be lost.

Angular Momentum

The angular momentum of the fluid entering the impeller vanes, about the axis of rotation, is

$$A\,M_i = m\,r_i\,s_i$$

The final angular momentum $A\,M_o$ of the fluid leaving the impeller, about the axis of rotation is:

$$A\,M_o = m\,r_o\,s_o$$

The change in angular momentum between the inlet and the outlet is $AM_o - AM_i$, and this is equal to the turning moment or the torque exerted by the impeller

$$t = m(r_o\,s_o - r_i\,s_i) \qquad (15)$$

The work done by this torque per second is

$$e = m(r_o\,s_o - r_i\,s_i)\ \omega \qquad (16)$$

The power imparted to the fluid can also be measured by the weight-time head qH (as in the case of incompressible liquids); the energy then is

$$q\,H = q/g\ (u_o s_o - u_i s_i)$$

and by dividing by q, we get

$$gH = (u_o\,s_o - u_i\,s_i)$$

which is the equivalent of equation (14).

Vortex

When a fluid is rotated by an impeller it tends to rotate at impeller speed about its axis, and the increase of pressure due to the forced vortex can be figured from the equation

$$(p_o - p_i)/k = (u_o^2 - u_i^2)/2g \qquad (18)$$

Where no energy is imparted to rotating fluid we have a free vortex. Since the angular momentum is constant, the torque $t = o$, and from equation (15) we obtain, for a free vortex,

$$r_o\,s_o = r_i\,s_i$$

or

$$s_o/s_i = r_i/r_o \qquad (17)$$

Therefore, the whirling velocity in a free vortex varies as $1/r$.

The law of the free spiral vortex can be derived from Bernoulli's equation: In any horizontal plane we have

$$p/k + v^2/2g = \text{const.}$$

and

$$(p_o - p_i)/k = (v_i^2 - v_o^2)/2g,$$

and since the whirl velocity varies as $1/r$,

$$(p_o - p_i)/k = (1 - r_i^2/r_o^2)\,v_i^2/2g \qquad (19)$$

This expression represents the maximum gain of pressure due to a vortex chamber of inner radius r_i and outer radius r_o. Actually the pressure increase will be much less, only about 40 per cent of the calculated value, which is due to friction. Hence the use of guide vanes is essential to efficiency in a blower.

From the total head H of a blower we can determine the pressure by means of the equation

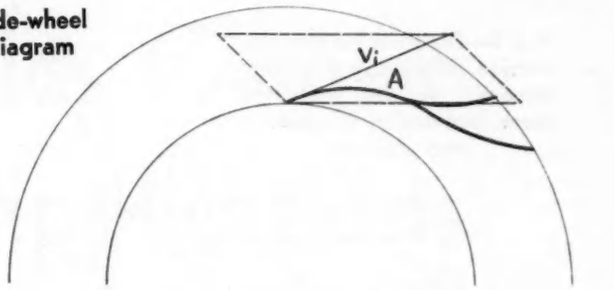


Fig. 6—Guide-wheel velocity diagram

$$p = H\,K_m \qquad (20)$$

where K_m is the average specific weight of the gas. For instance, 1 cu. ft. of air at atmospheric pressure and 60 deg. F. weighs 0.0764 lb. and 1 atmosphere is equal to 14.7 lb. per sq. in. or 2120 lb. per sq. ft., hence 1 atmosphere is equal to the pressure of an air column 2120/0.0764 = 27,750 ft. high.

In practice the following values are usually adhered to:

$u_o = 300 - 600$ ft. per sec.
$\beta = 20 - 40$ deg.
$\gamma = 30 - 90$ deg.
$r_o/r_i =$ from 2 to 3
$f_o = f_i = 75$—115 ft. per sec.

For isothermal compression:

$$K_o/K_i = p_o/p_i \qquad (21)$$

The average pressure:

$$p_m = p_i\,lg_{nat}\,(p_o/p_i) \qquad (22)$$

For adiabatic compression,

$$K_o/K_i = (p_o)^{\frac{1}{n}}/(p_i)^{\frac{1}{n}} \qquad (23)$$

The average pressure

$$p_m = p_i\,\frac{n}{n-1}\left[\ (p_o/p_i)^{\frac{n-1}{n}} - 1\ \right] \qquad (24)$$

Vane Angles

When designing a turbo compressor the impeller diameter is usually determined on the basis of the space available, the air volume desired, and the r.p.m. considered most suitable. The diameter having been chosen, the entrance-velocity diagram can be drawn.

The value of u_i is calculated and values of α and f_i are assumed; then from Fig. 5

$s_i = f_i \cot \alpha$
$v_i = f_i/\sin \alpha$
$w_i^2 = (u_i - s_i)^2 + f_i^2$
$\sin \beta/\sin \alpha = v_i/w_i$

From the exit-velocity diagram Fig. 5 calculate u_o and select γ and f_o. Then

$s_o - u_o = f_o \cot \gamma$
$w_o = f_o/sin\,\gamma$
$tg\delta = f_o/s_o$
$v_o = f_o/sin\,\delta$

In guide-wheel entrance velocity diagrams $\alpha = \delta$, $V_i = v_o$, and $F_i = f_o$ when $j_o = J_i$.

Losses in a blower are due partly to friction, but mainly to shocks and sudden changes in fluid velocity and in direction of flow, due to the fact that the entrance angles of the vanes are not equal to the inclination of the fluid streamline. A large portion of the friction head is lost in the clearance space and at the entrance to the guide vanes, due to shock. This occurs especially when the quantity of air is changed, when the guide vane angle will no longer correspond to the angle at which the air leaves the impeller, for the direction of the absolute velocity of the air changes with the quantity of air. About 50 per cent of the energy at the point of exit from the impeller is kinetic, and this must be transformed in gradual and easy divergent guiding channels. When a large divergency is used, the air does not follow the channel walls, and the change from velocity to pressure is not efficient.

Impellers are either open, with a web at one side of the vanes, or else enclosed, with a shroud on the outside of the vanes. Small impellers can be cast from aluminum and carefully finished and balanced; or they can be pressed out of sheet steel. The diffusion vanes also can be cast, but must be machined and polished; or they can be made from sheet steel. The best way for quantity production is to make impellers and diffusors of aluminum cast in permanent molds.

A gear-driven supercharger is expensive, since the gear train must operate continuously at speeds of over 20,000 r.p.m. However, by using a multi-stage construction, the speed can be brought down and ordinary steel can be used for impellers. Low-speed impellers are also easier to balance, the bearings and gears are entirely reliable, and they have longer life. Correct design of guide vanes and their angles increases the

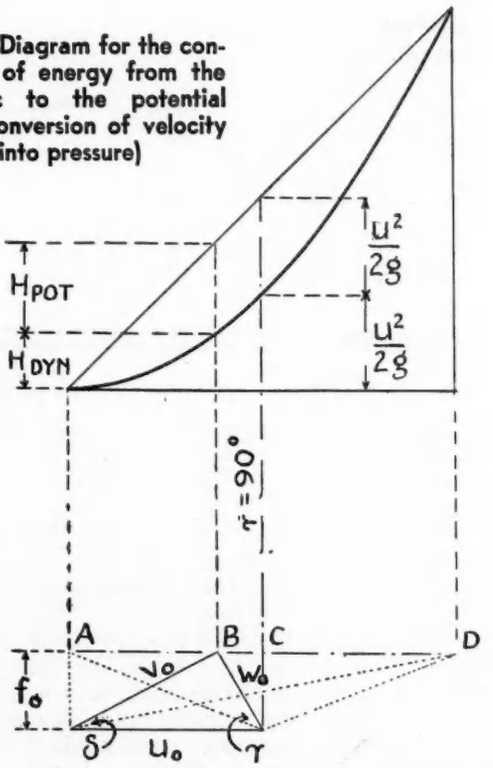


Fig. 7—Diagram for the conversion of energy from the dynamic to the potential form (conversion of velocity into pressure)

efficiency and the effective pressure increase, which in turn decreases the necessary speed still further. A low-speed turbo supercharger can be driven by a Vee belt, which is cheap and durable; the flexibility of the belt cushions the impeller, which latter in turn acts as a damper for the crankshaft. The writer has built a low-speed multi-stage supercharger with 8-in. carbon-steel impeller which weighs only 0.7 lb.

It is generally agreed that the specific output of modern engines can be substantially increased only by forced feeding or forced induction. In a supercharged engine, smaller valves can be employed, and cams giving lower accelerations and having moderate lifts. With a supercharger, practically perfect atomization and distribution of the gaseous mixture are obtained, with further improvement in fuel economy, power, acceleration and smooth running. For commercial vehicles a smaller engine can be used, running on practically full throttle in normal operation, and using a supercharger for maximum power, which will result in a saving of fuel, better mechanical efficiency, less wear and tear, and less gear changing.

Engine manufacturers can use superchargers on their present models and thus obtain units of greater output without developing entirely new designs.

There are greater possibilities in supercharging compression-ignition or Diesel engines. *Automotive Industries* of Dec. 2, 1933, gave results of N.A.C.A. tests on C.I. engines. The B.M.E.P. was increased from 80 to about 95 lb. per sq. in. when boosting to 8 in. of mercury and using normal valve timing.

Still greater improvements can be obtained by combining boosting and scavenging, which necessitates valve overlap. A boosting pressure of only 2.5 in. of mercury increased the B.M.E.P. from 80 lb. to approximately 110 lb. The greatest objections to C.I. engines are their cost and weight, and both these items can be substantially reduced by supercharging. In a recent test of marine Diesel engines it was shown to be possible to increase the B.M.E.P. 75 per cent by boosting.

One difference between supercharging gasoline engines and Diesel engines respectively is that in the first the mixture should be cooled on compression, while in the case of C.I. engines the compressed air should not be cooled, because the temperature increase of air favors ignition. Besides, the C.I. engine must work with a high compression when starting, when the supercharger—if driven by the engine—is not effective. For large stationary or marine engines the blowers can be driven either by electric motor or by exhaust turbine. Stationary Diesel engines operating at high altitude (say 10,000 ft.) should have superchargers to keep their size and cost down.

New Processes Break Records Cleaning Oils

EXTRAORDINARY records in dewaxing of motor oil are said to have been established by the propane dewaxing plant of Standard Oil Company (Indiana) at Wood River, Ill. Designed to handle 1200 barrels daily, this plant, without enlargement, has proved its capacity to process 1800 barrels in 24 hours. The new process filters wax out of oil approximately 100 times as fast as the old methods and does a complete job, yielding oils which flow at lower temperature than the products of older processes.

Solvent extraction has also proved highly successful. Greatly simplifying the removal of constituents not wanted in motor oil, it has reduced both the time and materials required to purify oils.

By the combination of the two processes oils are made of higher quality than was previously possible. To approach such quality by older processes would have been prohibitively expensive. The newer methods make it possible to sell such improved products at prices which the consumer is in the habit of paying.

The Wood River propane plant is said to be the first in the world to use propane as a refining agent for manufacturing high-grade oils.

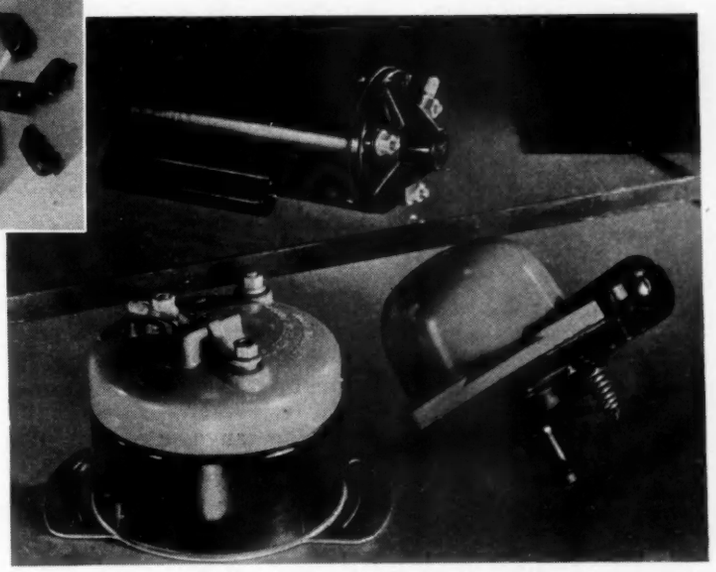
Phenolic Plastics Gain in Automotive Applications

by Herbert Chase, M.E.

Photos by Courtesy of General Plastics

A representative group of automotive parts, including ignition heads and rotors, bezels, escutcheon plates, dovetail blocks and knobs of several types, some having metal inserts, and all molded from Durez.

Ignition units which involve several major and some minor parts molded from phenolic compounds. Mallory's use of molded coil cases, which have fine appearance, excellent dielectric qualities and freedom from corrosion among their advantages, have set a high standard.



SEVERAL plastic materials, aside from rubber, are being employed in automobile construction today. Their use is by no means confined to dielectric applications. They serve also for structural, mechanical and decorative purposes. Of these plastics, the phenolic type is the most important. Phenolic moldings, though not so strong as most metals, present certain advantages which no metals duplicate. They have considerable strength and in some forms are less brittle than most cast metals. Their advantages, aside from their dielectric properties, are often overlooked.

Molded phenolic parts come from the mold in practically finished form. In general, only a light flash need be removed before the piece is ready for service. No application of lacquer, enamel or plating is needed either initially or in service. The luster imparted by the mold is retained indefinitely in most exposures and no corrosion ever takes place. With metal parts, finishing often costs two or three times as much as the piece itself and corrosion often makes refinishing necessary.

Noise and resonant effects are minimized with phenolic parts. This fact, together with good resistance to wear, accounts largely for the extensive use of phenolic timing gears. The spoked form is especially effective in noise reduction. Advantage of the noise-deadening properties might well be taken in other chassis elements, especially where metal-to-metal contact now results in noise. One of the new spring suspension systems, which does away with the conventional spring shackle, uses blocks of laminated phenolic material to form the bearing plates on which the ends of the springs rest and similar blocks are used as guides in other parts of this suspension. Their surface holds its shape and has shown almost no wear.

Another recent development involves the use of phenolic resins in molded rubber parts. Some of these, such as grommets and collars applied between metal parts, have soft tubular portions, whereas the flanges, which are exposed to view are harder and have a permanent luster, which is imparted by the resin. Such parts are unlike soft rubber which lacks luster and if painted soon shows a checked surface. The use of phenolic resin in rubber steering wheels should obviate the need for polishing these to improve initial ap-

pearance and should minimize or prevent loss of color or luster with exposure.

Graphite, sometimes employed in making molded and laminated phenolic parts, adds wear resistance, as the graphite acts as a lubricant. The surface of such parts is sometimes more wear-resistant than metal surfaces in contact with metal. This proved true in the molded Durez dovetail blocks employed by a large body builder in place of the metal formerly used. Such blocks do not corrode, require no lubrication, never freeze or stick, are highly water-resistant and are not easily broken.

The excellent bearing properties of phenolic materials is illustrated by their extensive use in roll-necks and similar steel-mill and paper-mill equipment, where they have often displaced bronze and babbitt bearings with an increase in life of four to ten times. Only water lubricant is required, but oil many be employed if desired. In such bearings, a lower coefficient of friction than with oil-lubricated babbitt and less deformation under load has been secured. Similar plain bearings might well prove successful in automotive applications. They never cut the shaft, but if run very long without water or other lubricant may develop a charred surface.

Molded phenolics are much used in ornamental parts, such as horn-button and spark-and-throttle-control units, various knobs for instrument boards, gear shifters, wind regulators and the like. They might well be used in ash receivers, vanity cases and similar items and would be lighter than some metal equivalents, besides costing nothing to finish. Entire instrument panels and garnish moldings could be formed from phenolic materials. As they would require no applied finish, there would be no finish to wear through where sleeve rubbing occurs. In addition to knobs, other decorative hardware could be molded, using metal inserts if required for added strength. Such hardware would certainly bring about freedom from finishing and corrosion troubles as well as a change in appearance which might be beneficial. Some escutcheon and switch plates are now molded and some dome-light frames are similarly formed.

Several makes of cast phenolics are now available in transparent and translucent form and in many beautiful colored effects. This type of material comes in rods, tubes and sheets for machining to shape or may be cast in finished form. Cost per pound is much above that for molded phenolics, but the beauty of the material makes it excellent for knobs, handles, buttons, fender markers, cigar lighters and like parts.

It is conceivable that, with various factors favorable, body panels and other body parts might be made from laminated or other types of phenolics. Factors favoring such construction would include light weight, excellent finish, and permanence thereof, nonresonant characteristics and freedom from corrosion. Naturally, this departure would involve a great change in present body-making methods.

Phenolic resins now go into such automotive products as brake linings, into many laminated washers and gaskets for insulating and other purposes, and into several types of finishes and insulating varnishes. They have been or might be employed in making hard-finished fabrics and other interior coverings, such as have gained extensive use in some 1934 cars. Further applications along this line may be anticipated. Head-linings and other interior trim could certainly be rendered waterproof and easily washable by proper treatment with phenolic compositions, and possibly the same might be done with exterior roof coverings, if indeed this has not been done already.

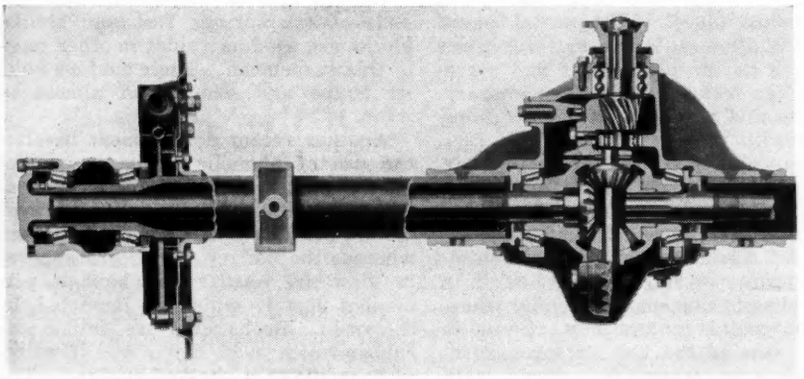
Should the future bring to the front an injection molding process, more or less analogous to die casting, further applications of plastics, phenolic or other types, are likely to result. This type of molding is now being developed and may eventuate in many useful combinations of plastics and metals, and perhaps in displacing metals in some instances.

New Full-Floating Salisbury Truck Axle

SALISBURY AXLE COMPANY, a division of Spicer Manufacturing Corporation, Toledo, Ohio, is now offering a type of full-floating integral axle for truck, bus and industrial installations. Advantages claimed for the design are simplicity, ruggedness, low cost of manufacture, and the utmost accessibility for service.

It is stated that these axles can generally be adapted for a particular installation without large tool cost. The brake flange can be located along the axle tube to suit any make of brake or width of brake form. Spring centers can be changed to meet requirements, as the spring seats are welded to the tubes. The angular relation of the pinion to the spring seat can be easily changed by rotating the carrier around the tube, prior to the welding operation. These changes could be made at any point in production without scrapping any material not assembled.

The floating wheel end permits servicing of axle shafts without disturbing the load on the truck. By using the single adjusting nut at the right-hand differential bearing it is also possible to service complete differentials which can be removed from the back opening of the axle. All oil seals are mounted in loose parts which can be removed so as to replace with new seals when required.

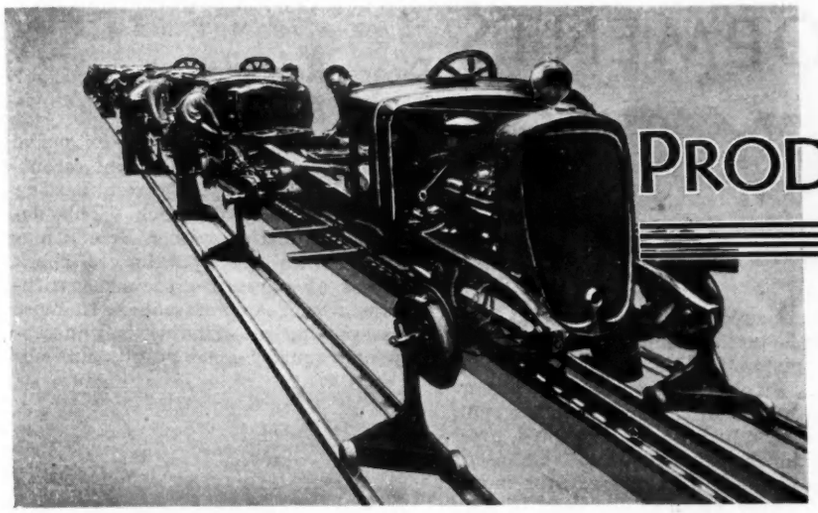


Sectional view of Salisbury commercial vehicle type full-floating axle

Efficiency in Welding

SPOT and seam welding machines equipped with General Electric Thyratron control, in the G-E Schenectady plant, have produced as many as 6,000,000 spot welds and 1,500,000 in. of seam welding on evaporator units for the G-E refrigerator without a single reject because of faulty welds.

The evaporator unit is made of stainless steel, each one requiring 310 spot welds and 75 in. of seam welding. The spot welding is carried out at the rate of 150 welds per min. and the seam welding at the rate of 72 in. per min.



PRODUCTION LINES

Machinery List

One of the most useful things we have seen yet is a booklet just issued by the National Machine Tool Builders' Assn. It lists completely for each member the types of machine tools and related products made by the individual company. Now you can tell at a glance just what your supplier has on the market.

Diesel Racer

Dave Evans, we understand, is preparing to try at some world's records with a special racing car provided with Diesel power (Waukesha Comet Head). That this may develop into more than a one-man affair is quite in the cards. Our authority for this is a conversation we had recently with a man who feels that he is a pioneer in this automotive Diesel development. And he will permit no competition to go unchallenged. Maybe we're to witness a battle royal.

Industrial Rubber

Goodrich has just issued a combination catalog and engineering data book on industrial rubber goods. It is intended as a guide to the selection of belting, hose and other products. Should serve a very useful purpose in the purchasing department and the works manager's office.

Safety Glass

A tentative code for safety glass has been prepared by the ASA committee headed by Alfred W. Devine of Massachusetts and is being submitted for letter ballot vote. It was found impossible to write specifications which would differentiate between acceptable and non-acceptable glass for all purposes, and accordingly the committee has recommended groups of tests, giving options as to the series of tests to be performed.

Broaching Spreads

Plymouth was the first to use surface broaching for cutting the bearing locks in the cylinder block, back in 1932. This operation is now in use in the production of the Pontiac six block as well as the Packard 120. We understand that Nash is about to start this operation, using a newly developed machine.

Six Lectures

Philadelphia Chapter, ASM, has arranged a special series of six lectures on stainless steels for the benefit of its membership. The course will be given by outstanding authorities in the field and will cover the principal applications of commercial grades together with the accepted methods of fabrication.

Moot Question

Going through a Detroit plant which was recently retooled, we find that there still is a tendency on the part of suppliers to overestimate the productivity of certain equipment. Nothing is more fatal to both the production department and the machine tool builder than to fall down on the guaranteed production rate. Here is a point that should be of greatest concern to the machine tool builders catering to the automotive industry.

Surface Broach

Two outstanding applications of surface broaching are in the offing. One is the finishing of the crankcase side in production—and this is coming through very soon. The other contemplates the forming of the connecting rod contour, overall, after a coining operation, in an effort to attain better balance without undue cost.

Fuel Pump

Ex-Cell-O has just sent us a very handsome wall chart showing the innards of their new diesel fuel injection pump. It features a colored sectional view of the unit which tells the whole story. You can get one, too, if interested.

Profitable Hobby

It may interest you to know that a certain quality control man in Detroit has a very unique and profitable hobby. He operates a farm and breeds blooded stock in the way of cows, hogs, etc. We are told that his Guernseys have taken a number of first places at State Fairs.

Valve News

Joe Anglada, known to many of you, was out in Detroit during the SAE meeting showing some interested people a new form of valve gearing suitable for any type and make of engine. It eliminates gears, springs, mechanism, etc., and is said to cut production and assembly costs.—J. G.

MANUFACTURING MANAGEMENT METALLURGY

NEW DEVELOPMENTS
Automotive Parts, Accessories and Production Tools

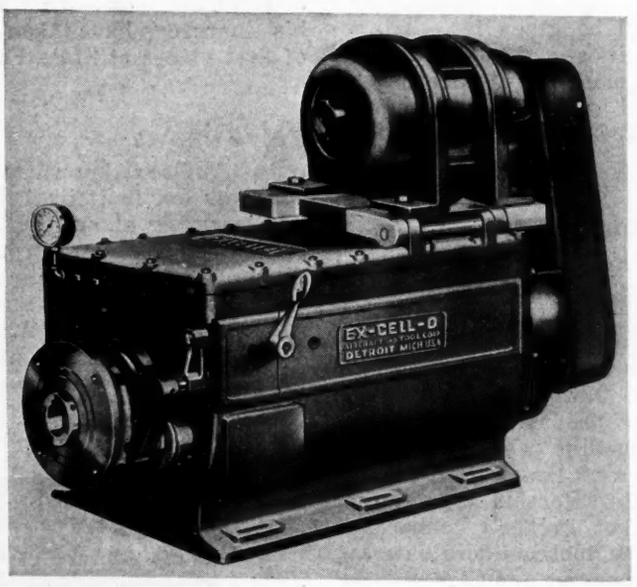
Hydraulic Power Unit

Ex-Cell-O Aircraft & Tool Corp., Detroit, Mich., announces a self-contained, compact hydraulic power unit for drilling, reaming, counterboring, spotfacing and similar operations. The hydraulic power unit illustrated is available in three sizes to meet the general demands for this type of unit. It can be mounted in any position either singly or in multiples and operated individually or collectively with a manual or by remote control. The small unit, No. 23, has an 8-in. stroke; the medium, No. 25, has a 10-in. stroke, and the large, No. 28, has a 12-in. stroke.

These units are adjustable for length of stroke, length of rapid traverse and length of feed. The rate of feed can be easily changed from the outside of the unit by graduated adjusting valves while the unit is feeding, permitting the selection of the most suitable feed. There are two forward feeds each independent of the other. Adjustable dogs for controlling the rapid traverse, feeds, stop and reverse of the unit are provided.

All essential parts are accurately machined, hardened and ground. Alloy steel parts are used wherever possible to insure long and uninterrupted service.

The electrical motor is mounted on an adjustable base located above the unit proper. It drives the hydraulic pump and drive shaft by "V" belts. The spindle is supported at both front and rear ends in the main quill which carries a piston that is hydraulically operated. By changing pressure at either end of the piston the main quill or ram moves either forward or backward, providing the feed for the unit. The speed of the spindle can be altered by removing the cover plate at the rear of the unit and changing the speed gears.



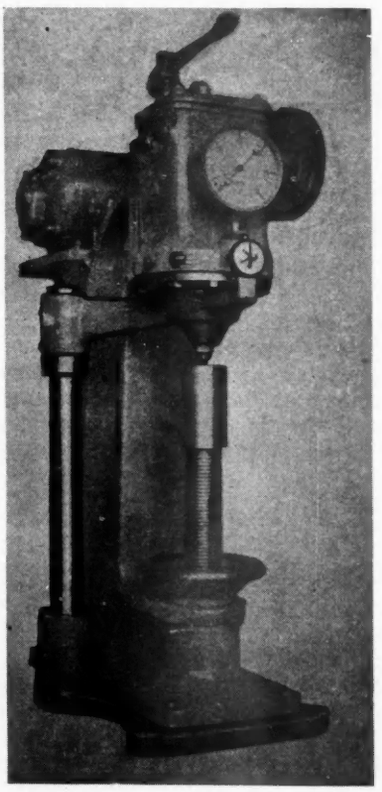
Neu-Tak Hammer

From an internal magazine that holds a clip of 50 staple-tacks, the Neu-Tak hammer made by The Burgess Co., Inc., 15th and 10th Streets, Beaver Falls, Pa., feeds these staple-tacks mechanically to the face of the hammer, where they are held in position until driven. With this mechanical hammer, staple-tacks can be driven, using only one hand, as fast as the operator wishes to work. As each staple-tack is driven the next one is rotated into driving position by "cocking" the hammer, which is a simple wrist-pressing movement of the hammer against the working surface.

Fast work without fatigue, because the hammer, even when loaded, is light and well balanced. In action, it is similar to the magnetic hammer without the awkward and dangerous practice of holding tacks in the mouth. It is designed for use in any position, corners or close quarters. At any angle, the staple-tack adheres to the hammer face until driven.

Direct Reading Brinell Attachment

Of interest to those doing extensive Brinell testing is an attachment recently introduced by the Detroit Testing Machine Co., Detroit, Mich. This device, in conjunction with a Brinell machine, enables the operator to check hardness of parts or specimens without the use of a microscope. In most cases spotting or grinding is unnecessary and equally good results are ob-



tained on flat, rounded or odd surfaces. Tolerance hands are set to the desired limits and the operator merely notes whether or not the pointer stops between them.

The construction is unique in that the indicating instrument is supported independently and errors due to frame deflection or distortion are entirely eliminated. A degree of accuracy hitherto unattainable is claimed for it. This arrangement also makes the device adaptable to all makes of existing machines including those with a deep work gap or of special design.

Although developed primarily for use on power-driven Brinell machines, it may be used to advantage on the hand-operated type where large numbers of similar pieces are to be tested. A rate of 600 tests per hour is said to be possible under favorable conditions.

Rubber-Like Product Now Practical

A new rubber-replacing material called "Koroseal" has been developed

by The B. F. Goodrich Company, Akron, Ohio. At present the prohibitive cost of manufacturing Koroseal precludes its adoption as a general substitute for rubber, but some of its characteristics render it far superior to rubber for certain specialized applications.

Although not the same as rubber in chemical composition, it may, like rubber, be varied by compounding methods from very hard to soft, doughy consistency and can be molded into any shape. Koroseal can be produced, also, in a variety of colors. It is odorless.

The resistance of Koroseal to swelling when exposed to many oils and greases and to disintegration in the presence of corrosive chemicals is unusual. It even resists the action of chromic acid and hot, concentrated nitric acid. The new material also has been shown to be ideal for a piston packing because of the tight seal afforded by the Koroseal compound in the presence of oil.

Electric Drills Redesigned

Van Dorn Electric Tool Company, Towson, Md., has completely redesigned the most popular drills in the Van Dorn line. Smooth, rounded surfaces, improved motors and other new developments are said to give them perfected balance, easier handling, increased power and lighter weight.

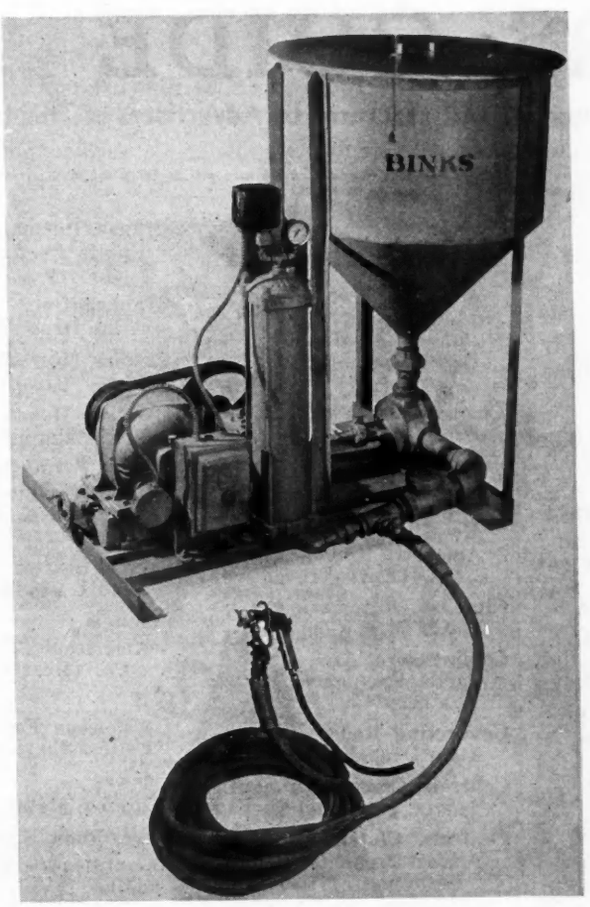
The ¼-in. heavy duty drill is an economical unit built for heavy duty drilling on continuous production work in large machine shops.

The 5/16-in. electric drill is used for constant production drilling, in wood or metal, and is especially suited for lead-hole drilling in wood.

New Unit Sprays Sound Deadener

A new unit for spraying heavy materials, such as the heavy asphalt composition used for sound deadener on car bodies, has just been announced by the Binks Manufacturing Company, Chicago, Ill. The illustration shows the unit equipped with a 60-gallon tank which has recently been installed in the plant of the Seaman Body Company (body makers for Nash) at Milwaukee.

Located at the base of the tank is a pressure pump having a capacity of 1½ to 2 gallons per minute. It is operated by a 1½-hp. motor, and by means of an adjustable reduction gear, variations in pressure can be obtained. This pressure is kept at an even rate by means of a compression chamber.



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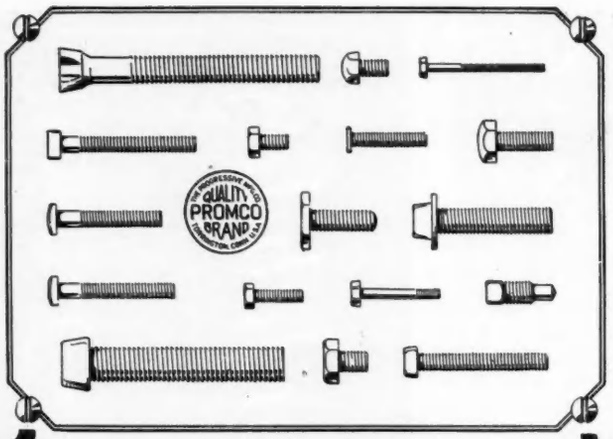

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The illustration indicates a few of the many special parts that we have developed for other manufacturers

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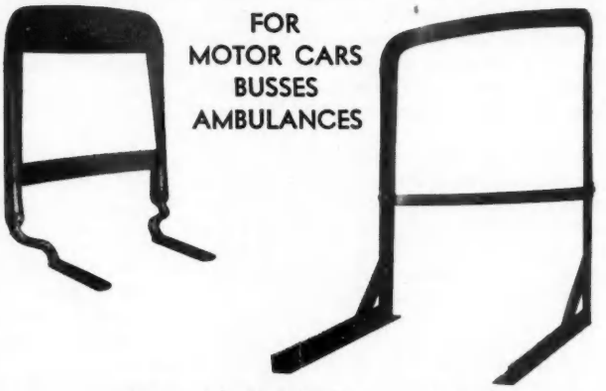

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Automotive Products and Factory Equipment Manufactured by Advertisers in This Issue

See Alphabetical List of Advertisers on Page 40

This Adveertisers' Index is published as a convenience, and not as part of the advertising contract. Every care will be taken to index correctly. No allowance will be made for errors or failure to insert.

Arms & Knuckles, Steering
Atlas Drop Forge Co.

Axles
Atlas Drop Forge Co.
Spicer Mfg. Corp.

Bearings
Bronze & Steel Back Babbitt Lined
Bohn Aluminum & Brass Corp.
Roller (Tapered)
Timken Roller Bearing Co.

Bending & Straightening Machines
Chambersburg Engineering Co.
National Machinery Co.

Blanks
Forged
Atlas Drop Forge Co.

Boring Machines
Baker Bros., Inc.
Foote-Burt Co.

Brakes
Hydraulic
Bendix Products Corp.
Mechanical
Bendix Products Corp.
Power
Bendix Products Corp.

Brake Testers
Bendix Products Corp.

Broaching Machines
Foote-Burt Co.

Bushings
Brass & Bronze
Bohn Aluminum & Brass Corp.
Fibre
Continental-Diamond Fibre Co.

Cable
Brake or Cutout Control
Amer. Steel & Wire Co.
Ignition, Starting & Lighting
Amer. Steel & Wire Co.

Camshafts
Atlas Drop Forge Co.

Carburetors
Bendix Products Corp.

Castings
Aluminum
Bohn Aluminum & Brass Corp.
Brass & Bronze
Bohn Aluminum & Brass Corp.
Die
Bohn Aluminum & Brass Corp.
Malleable Iron
Timken Roller Bearing Co.
Permanent Mold
Bohn Aluminum & Brass Corp.

Channels for Glass
Felt
American Felt Co.
Felters Co., Inc.

Cleaners
Metal
American Chemical Paint Co. (Rust Preventive)

Clutches, Automatic
Spicer Mfg. Corp.

Compressors, Air
Curtis Pneumatic Machinery Co.

Connecting Rods
Atlas Drop Forge Co.

Controls, Choke (Automatic)
Bendix Products Corp.

Controls, Clutch
Bendix Products Corp. (Automatic)

Cranes, Pneumatic
Curtis Pneumatic Machinery Co.

Crankshafts
Atlas Drop Forge Co.

Cutters (Keyseating)
Baker Bros., Inc.

Cylinder Heads
Bohn Aluminum & Brass Corp.

Drilling Machines
Baker Bros., Inc.
Foote-Burt Co.

Drives, Starter
Bendix Products Corp.

Enamels
American Chemical Paint Co. (Rust Proofing)

Felt
American Felt Co.
Felters Co., Inc.

Fenders
Motors Metal Corp.

Fibre, Rods, Sheets, Tubes
Continental-Diamond Fibre Co.

(*Turn to page 38, please*)